

POPULAR MECHANICS MAGAZINE

WHEREVER YOU CAN UNDERSTAND IT

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What, no crankshaft?—Turn to page 114 for the story of the

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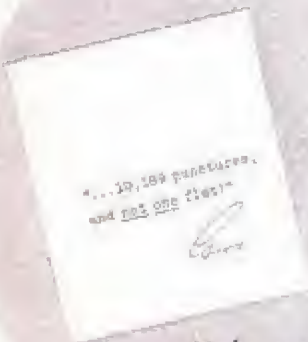


broken
glass . . .



any sharp
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Name

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This One



Mounting Bell's new microwave lens in a horn-lens antenna. Other blocks will complete the lens.



A focus on better, low-cost telephone service

In the new microwave radio relay system between New York and Chicago, giant lenses shape and aim the wave energy as a searchlight aims a light beam.

Reasoning from the action of molecules in a glass lens which focuses light waves, Bell Laboratories scientists focus a broad band of microwaves by means of an array of metal strips. To support the strips these scientists embedded them in foam plastic which is rigid, light in weight, and virtually transparent to microwaves.

This unique lens receives waves from a wave guide at the back of the horn. As they pass across the strips, the waves are bent inward, or focused, to form a beam like a spotlight. A similar antenna

at the next relay station receives the waves and directs them into a wave guide for transmission to amplifiers.

This new lens will help to carry still more television and telephone service over longer distances by microwaves. It's another example of the Bell Telephone Laboratories research which makes your telephone service grow bigger in value while the cost stays low.

Laboratory model of the new lens. A similar arrangement of metal strips is concealed in the foam plastic blocks in the large picture.



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Popular Mechanics Magazine

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H. H. WINDSOR, Founder

H. H. WINDSOR, JR., Editor and Publisher



this month's cover

FROM A DEAD STOP that truck on our cover can take off with the pick-up of a scared Arizona jack rabbit. It can scoot up a Rocky Mountain with the zip of a motorcycle. Of course, it hasn't been built yet, and neither has the passenger car that will roll you 50 or 60 miles on a gallon of cheap kerosene—but both these developments are theoretically possible as the result of a revolutionary engine so simple you'll wonder why it wasn't dreamed up back in the days of the Model-T. It's the free-piston engine, consisting of two pistons connected to absolutely nothing. The pistons slide back and forth in a chamber, burning fuel and compressing air. Hot gases from the engine flow through a turbine to power most anything. J. D. Ratcliff, noted science writer, gives you the details on the newborn but power-packed youngster, on page 114

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SEPTEMBER 1950

Number 3

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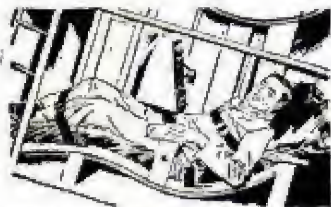
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The Greatest Adventure Awaiting Mankind!



SEE the pull of gravity crush them deep into their crash-couches as the space-ship takes off at 32,000 feet a second.



SEE the flyers risk death as they crawl outside the space-ship to repair their short-wave aerial—their only link with Earth.



SEE the slip that sends a crew member adrift in space—facing the doom of floating forever in the vast black universe.



SEE Man's greatest thrill as he finally sets foot on the Moon! Now, at last, his age-old dream of conquering space comes true!



It's closer than you Think!

Be there! Be with the first men to ride a space-ship to the Moon! It's spine-tingling, perilous adventure!

See how the greatest news story of all time will actually happen! Share this adventure into tomorrow!

Two years in the making, this is the picture you have heard about and have been reading about in *LIFE*, *THIS WEEK*, *PARADE*, the popular science magazines, *New York Times* and many more.

It's a prophecy—not a fantasy! Watch for it at your favorite theatre!



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DESTINATION MOON

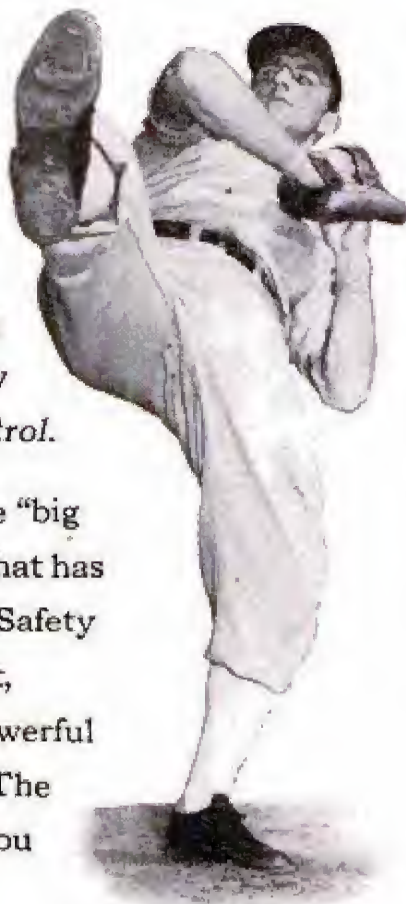
Produced by GEORGE PAL. Directed by IRVING PICHEL. Screenplay by RIP VAN RONKEL, ROBERT HEINLEIN and JAMES O'HANLON

Big Wheel

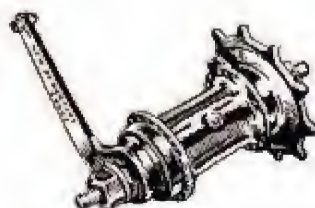
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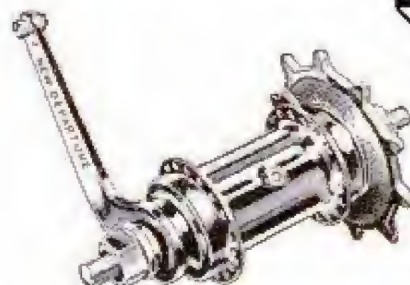


A Boy, a Dog... and a Bike

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in this corner.....

THE EDITORS



Atomic Golf Ball

We told you it was coming—the atomic golf ball that you couldn't lose in the rough. In Wayne Whittaker's article (October 1949) about the Nuclear Instrument and Chemical Corporation, the "Million Dollar Baby of the Atom Age," he told of the inquiry for 200,000 portable Geiger counters to be used for hunting atomic golf balls. Well, here it is—the radioactive golf ball—produced experimentally at the B. F. Goodrich Research Center in Brecksville, Ohio. And Geiger counters are getting down in weight and price so you might save money by toting one around the course to retrieve "slices" from the neighboring wheat field. The radioactive ball is not yet being manufactured, however. There are problems. The radioactivity of the ball is low enough to avoid danger to its user, but in wholesale lots they might prove dangerous to the handler. For the time being, just stay out of the rough.

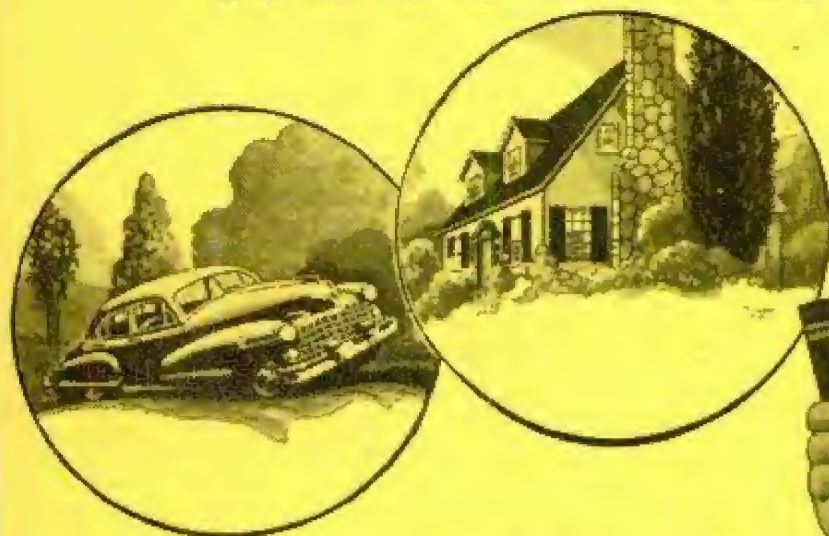
* * *

But Will It Get You Up?

One of General Electric's latest products is introduced as a "triumph of science over human nature." Well, it does have some admirable and amazing characteristics, but

(Continued to page 8)

5 reasons why ACCOUNTANCY



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REASON #1. If you were an expert accountant right now, chances are you would find yourself among the highest-paid of all professional men and women. Even back in "depression years," surveys showed that accountants earned more on the average than men in other major professions.

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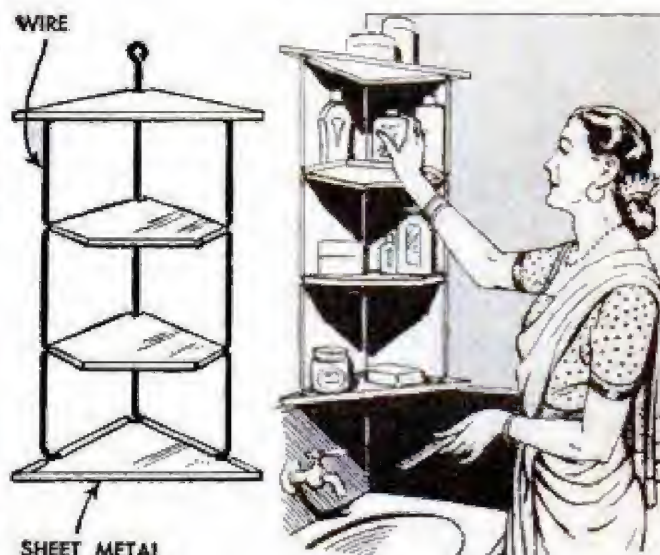
Check One ☐ Veteran ☐ Non-Veteran

TRAIN IN MIAMI—AIR CAPITAL OF THE WORLD

(Continued from page 6)

on the other hand—it's an alarm clock. Set it for the hour you want to be awakened and it will reset itself to ring at that hour every day until you shut it off. This ruins that "I forgot to set the alarm" alibi. But if you forget to turn it off on week ends, blame nobody but yourself.

* * *



Round-the-World Idea

To the Editor:

Please turn to page 195, April '47 issue of your esteemed magazine. We wonder how many Americans thanked P.M. for the idea . . . "Single-Board Bathroom Cabinet." But we have every reason to thank you sincerely . . . It struck us that a "corner cabinet" will be useful not only in a bathroom but in almost every room . . . The immediate result . . . was translation of this idea into a sheet-metal corner shelf . . .

It suited local city market best. But gradually when demands poured in from neighboring cities we began scratching our heads, the worst snag being the packing problem . . . We were already in possession of an Indian patent . . . for a novel method of manufacturing improved metal furniture by eliminating . . . bolts, nuts, rivets, screws or springs . . . The same method was applied to make the corner shelf portable . . .

Even though we have improved and adapted the information provided by you to suit our own needs . . . for the basic idea underlying all this development we heartily say "thank you" to *Popular Mechanics*. Now we leave it to you to make the best use of the information contained herein in your future issues.

Yours faithfully,
Allied Engineering Industries,
Bangalore 3,
South India.

(Continued to page 10)



"I pinned my hopes to a penny postal"

JESSE K. KIMBALL
Chief Building Inspector, Washington, D. C.



"I often wonder what sort of job I'd have now if it were not for a penny postal and the International Correspondence Schools.

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Letter to the Editor:

Not often does *Popular Mechanics* make a blunder, but here is one for the book. Page 143, July 1950 issue, "Siamese Twins" bulldozer: "Two tractors hitched in tandem... made by joining two conventional Caterpillar tractors side by side." If they are "tandem" hitched, they just can't be "side by side," or if they can, please show us how!

Cordially,
G. A. Lechlitter, D.D.,
South Florida Baptist Hospital,
Plant City, Fla.

We've ordered another dictionary for one of the editors.

* * *

Knothole for a Gnat

Department of Defense officials, who normally point with pride to the development of bigger bazookas or more titanic tanks, announce a recent accomplishment—a hole. Believed to be the smallest ever drilled in a piece of metal, it is only 60/100,000 inch in diameter, about the size of the thinnest invisible strand of silk spun by a spider. It can't be seen without the aid of a high-powered microscope. The hole, drilled through a piece of platinum with a standard jeweler's lathe, will be an essential part of the hydraulic system of one of the Navy's new weapons.

* * *

It's a Rough Trip to the Moon

Volunteers for rocket trips to the moon had better have seasickness pills ready, according to Dr. William Kellogg of the University of California at Los Angeles. Just finishing a study of upper-air atmosphere, he reports an area 50 to 60 miles above the earth with storms that dwarf the most violent Atlantic hurricanes or Pacific typhoons. The winds sometimes reach velocities of 600 miles an hour. Doctor Kellogg believes the high turbulence results from the rapid exchange of heat between a layer of atmosphere that absorbs large amounts of ultraviolet radiation from the sun and a cooler layer just above it.

* * *

Children of the Dawn

In China two years ago scientists discovered seedlings of the Dawn Redwood, previously believed to be extinct for millions of years. They planted 66 of the seedlings in Alaska. Latest report: 46 of the little fellows are known to be alive and may flourish into forest giants that would make their age-old forefathers proud.

WHAT Every AUTO MECHANIC Wants to Know

A motor vehicle is a machine of many parts, each part designed and constructed for its own special function. All good mechanics, like good doctors, should know the working theory and operation of each part and understand what causes trouble and how to remedy it.

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Every auto mechanic, helper, serviceman and operator can use AUDELS AUTO GUIDE. The information it gives saves time, money and worry. Highly endorsed by all users. It presents the whole subject of auto mechanics from A to Z in plain language and simple terms.

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A complete Guide of 1800 pages, with over 1500 illustrations showing inside views of the working parts, with instructions for service jobs. Diesel engines, Fluid and Hydra-matic drives fully explained.

IT PAYS TO KNOW HOW TO

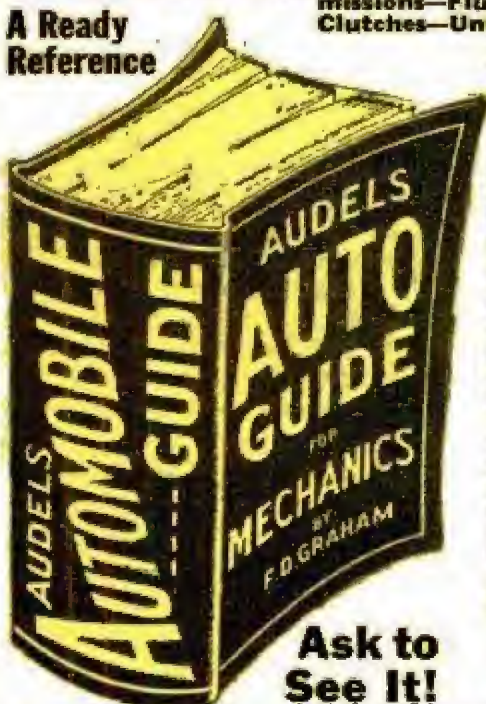
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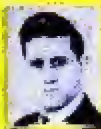
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A. HERR, New C., Pa., writes, "Have doubled my salary since starting in Radio full time. Am employed by Station WKBO as transmitter operator. Future looks bright to me."



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LEANDER ARNOLD, Pontiac, Mich., says, "While learning, made \$5 to \$10 a week repairing Radios in my spare time. Now I have a spare time shop in my home."



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H. B. MILLS, Washington, Ohio, finds, "Word traveled fast in regard to my N.R.I. training. Have been doing Television installation and servicing, tracing out and eliminating interference, etc."



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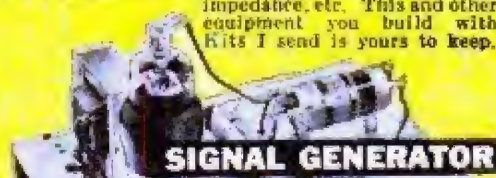


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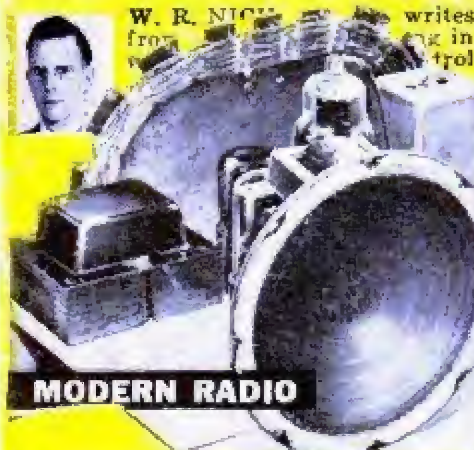
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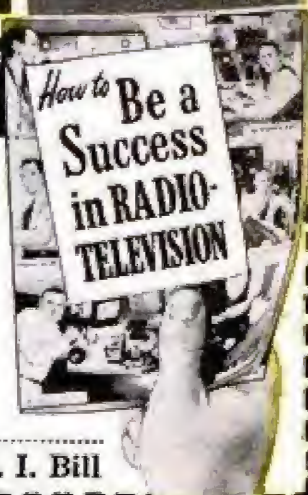
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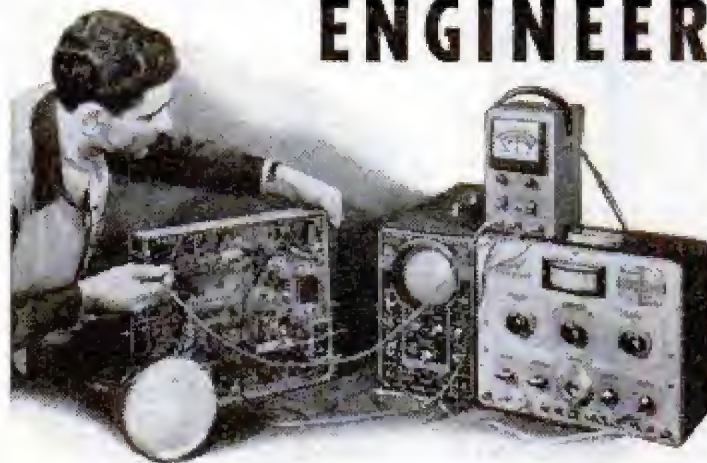
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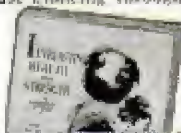
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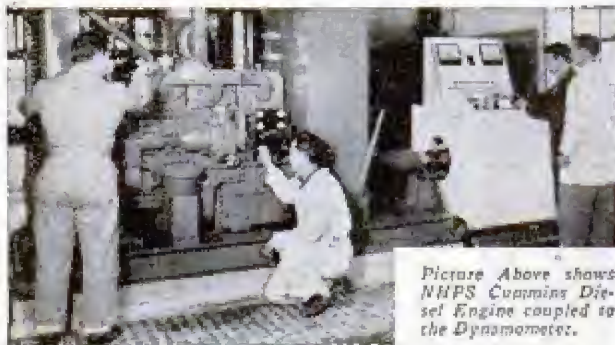


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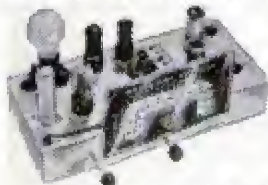


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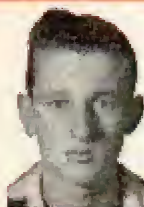
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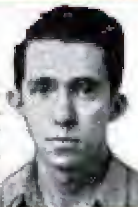
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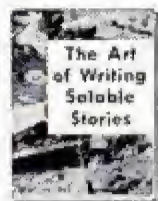
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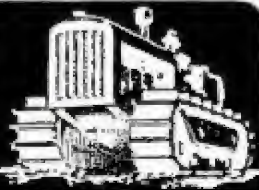
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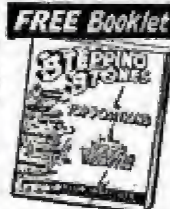
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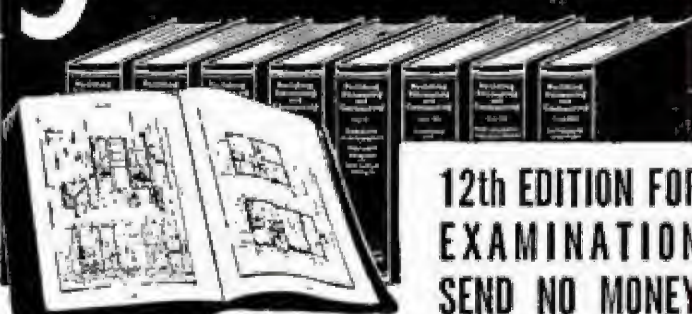
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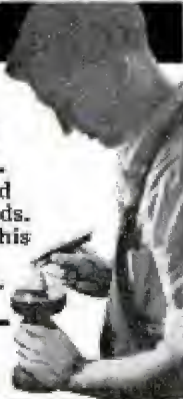
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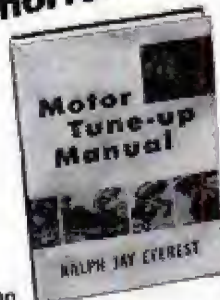
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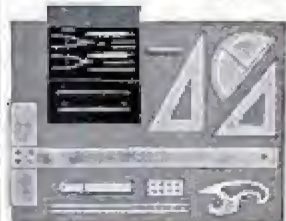
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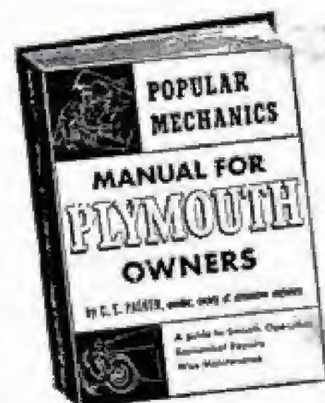
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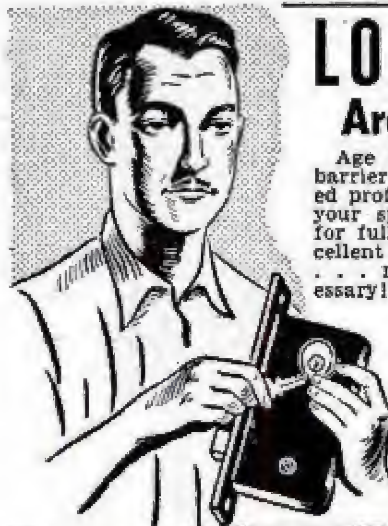
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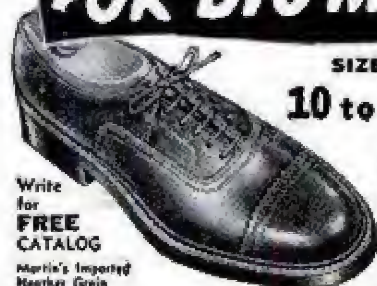
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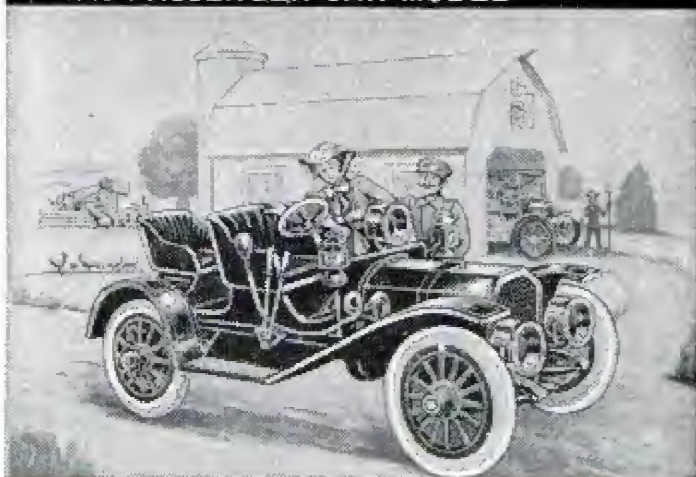
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FORGE Ahead financially! Start profitable business; mail, locally! Amazing invention. Free sample offer! Consolidated Equipment Corporation, 791 Guardian Bldg., Cleveland 14, Ohio.

MILLION Articles wholesale. Directory 25c (refundable). Publishers, Box 1302, Detroit 31.

10 NOVELTY Plans, 25c. Valcal Service, Box 1506, Vallejo, Calif.

SECURITY! Manufacture everyday demand products! Tremendous profits! Formula lists free! Thermolab, Peoria 4, Ill.

"WATERLESS (Lanolin) Hand Cleaner." (Oil base.) Make, sell. No machinery. Build profitable business. Complete formula \$1.00. Ideal Service, Park Ridge 1, Ill.

COIN Operated telescopes produce high earnings. Ideal full or part time business wherever there are scenic views and pedestrian traffic. Telescopes sold, rented, leased or operated with you on fifty-fifty basis. Write or wire American Telescope Company, Evansville 3, Indiana.

PROFITABLE Business at home mimeographing letters. Proven plans, Carlson Letter Service, Mankato, Minnesota.

1000 GOLDEN Opportunities! Most amazing new money-making home occupations! 600 illustrations! Beautiful gold sample free! Stamp brings details. C. Bellehaven, P.O. Box 606, Redwood City, Calif.

DOLLARS Three ways with "Kitty-Kat" readi-cut baby shoes. Complete local and mail order plans. Write No-Co-Ro, Oakland 6-K, California.

ENORMOUS Profits and fun galore making sensational new glass ornaments. Huge demand. Samples, diagrams, easy-to-follow instructions \$1.00. Hobby, 243 S. Lexington, St. Paul 5, Minn.

MAKE More money with moneymaking secrets. Free facts. Service Bureau, Box 2625, Orlando 5, Fla.

MAKE Perfume at home—Men, women. Write International, 6347 Parnell-FM-9, Chicago 21, Illinois.

MAKE Real money selling all-metal interlocking weatherstrip, wire sweater blocker, or caulking compounds. Liberal commissions to good man. For details write E-Z-On, 1009 Harvard, Evanston 2, Ill.

EARN \$100/\$250 Weekly. Installing, maintaining fluorescent lighting. Proven business opportunity. Free facts. "Fluorescent," 712-A State Tower Bldg., Syracuse, N. Y.

WANTED. Men to operate profitable electroplating and mirror shops at home, part time or full time. We furnish electroplating equipment and training. Write Tyco Metals, Box 12004C, Houston 17, Tex.

NEW Industrial hand cleaner! Sensational product. Immense market. Tremendous possibilities. Unusual money-making plan free! Keenelo, 2438 Fifteenth, Denver 11, Colorado.

MAKE Big money selling by mail. I do, everyday, from my home. You can too. Write me today, I'll tell you how. Superior, 48D, Englewood, Colorado.

BABY Shoe mountings. Bookends, frames, etc. St. Albans Plating and Casting, 135-17 135 Ave., So. Ozone 20, N. Y.

\$46 FROM Square-foot plywood. Jigsaw necessary. Write, Woodarts, X-38, Bridgewater, Mass.

\$200 WEEKLY Reported! No selling. Free booklet. T. J. Surface, Roanoke 4, Virginia.

FOR Pleasure or profit. Make inexpensive gorgeous Simplex plastic statuettes and costume jewelry. Sell to stores or friends. Complete illustrated instructions only one dollar. Thermal Company, 17 Guilford Avenue, Baltimore, Maryland.

EXTRA Money at home casting silver rings? Details free. Western Silvercraft, Box 574-I, Great Falls, Montana.

FREE Details! "The Magic Formula for Mailorder Success." Mailord Company, 204-C9 East 81, New York 28, N. Y.

MEN — Women, sell money-making household items from fully illustrated catalog. Sales outfit free. National, Box 88, Boston 22, Mass.

MAKE Money spare or full time casting metal toys and novelties. Big wholesale and chain store demand for autos, soldiers, ashtrays, banks, etc. keep manufacturers busy. Production moulds furnished for up to 100 and more castings per hour. No experience or special place necessary. "Cash-in" on holiday orders now being placed. Write for information and illustrations of patterns needed. Metal Cast Products Co., Dept. A, 1696 Boston Road, New York 60, N. Y.

OWN A printing business. Good profit printing cards, stationery, etc. in spare time. Easy rules furnished. Have home shop. Send dime for complete printer's supply book and samples. Kelsey, Inc., Z-24, Meriden, Conn.

MAKE Products yourself. No machinery needed. Work at home. Build big business. One and two ingredient formulas. Over 50 fast sellers. Just package and label. Complete set only \$1.00. Neiko Chemical Service, 3462-F Merchandise Mart Sta., Chicago 54, Ill.

LEARN Sewing machine repairing at home. Earn \$125.00 week spare time. Plus, new machines, motors, etc. wholesale. Free particulars. Taylor Service Co., Hamilton, Ohio.

BOOKKEEPERS Earn \$100.00 week operating your "bookkeeping service." Simplified plan. Information free. Bookkeeping Service, Box 664-M, Springfield, Missouri.

SOMETHING New — Preserving baby hand and foot prints with life like relief as beautiful wall plaques. Complete course, equipment and material offered. Details. Steepleton, 3136 Walnut Street, Huntington Park 2, California.

OPERATE Profitable mail order business. Particulars free. George Lenhoff, Lincoln 8, Nebraska.

START Mailorder business. Complete plan. Satisfaction or refund. Valuable sample 25c. Hughes, 4327 Dalton, Los Angeles 62.

BRONZED Baby shoe mountings, equipment and supplies. Buy wholesale from world's oldest and largest manufacturers of all metal mountings. Sales Dept., Hollywood Bronze Supply, 6141 S. Wentworth Ave., Chicago 21, Illinois or 1766-70 North Vermont Avenue, Hollywood 27, Calif.

LEARN Gun repairing at home. Profitable. Modern Gun Repair School, Box 717, Dubuque, Iowa.

SPIN Angora wool into yarn. Interesting work. House of Angora, PM5, Springfield, Illinois.

HOME Business making statuettes, plaques, artificial marble, rubber molds. Silvering mirrors. Formulas. Folder free. Creative, 236-L, Winnetka, Illinois.

MIRROR Resilvering. Wonderful home business. Complete formula 25c. Magic two-way mirrors. You can see out—no one can look in. Formula 50c. How to make coppered mirrors, vases, glasses. Formula \$1.00. All three \$1.50. Neiko Chemical Service, Box 3462, Chicago 54, Ill.

WEST And northwest Canada. Tourist attractions, oil, mining, farming, trapping, hunting, Alaska highway. Land of opportunities. Booklets, maps. Any information. \$1.00. Box 354, Edmonton, Alberta, Canada.

SEND For "1001 Ways to Make Money," 25c (refundable). 1001 Opportunities Club, 1495 Westchester Ave., New York 59.

BUY It wholesale! Manufacturers, distributors offer \$50,000 items. Literature free. Olsen, 1231-A East Third St., Duluth 5, Minn.

UNPAINTED Figurines. Beautiful models. Write for new wholesale price list. Oman, 642J Broadway, St. Paul 1, Minn.

SPECIAL Rubber for making molds. Literature and sample free. Universal, Box 1076-A, Peoria, Ill.

COPUBLISH Leading m.o. paper. Latest copy Mail Sale Advertiser, details, dime. Vanroy Shirk, Lebanon, Penna.

MADE \$24,500 Using money making plans from Schemer Magazine, world's oldest mailorder publication. Box 775M, Alliance, Ohio. Year \$2.00. Sample 20c.

WRITE For free booklet and catalog telling how to earn substantial profits in your spare time by forwarding new and renewal subscriptions to all magazines for your friends and neighbors. Oldest U. S. agency. Established 1869. Moore-Cottrell, North Cohocton, New York.

MAKE Flexible molds! Cast plaques, bookends, figurines! Free sample! H. Tooker, 636-R Chestnut, Hamilton, Ohio.

BE Appointed state notary public now! Details. Stationers, Helotes 50, Texas.

COMMERCIAL Deep frying course. Mock chicken legs, potatoes. New and proven methods. Learn about this money-making field. \$2.50 p.p. Concession, Toledo 13, Ohio.

MAKE Rubber stamps, metalize baby shoes, repair dolls, silver mirrors, make beautiful figurines. Catalogue of "30 ideas" free! Universal, Box 1076-A, Peoria, Ill.

NATURAL Molding Latex. Extra thick. Free sample. W. Wooley, 115-A Donald, Peoria, Ill.

PROFITABLE Business making and building with easy-laying interlocking building blocks. Rex Products, Dept. 10, Piqua, Ohio.

POPCORN Poppers, peanut roasters, copper candy, caramels, corn kettles. Northside Co., Indianola, Iowa.

\$250 WEEK Reported! Free illustrated book "505 Odd Successful Businesses." Work home! Expect something odd! Pacific-E. Oceanside, California.

YOUR Own profitable home business. Preserve live flowers to last forever. New simple discovery. Enormous demand all year 'round. Tremendous profits! Light fascinating work. Send \$2.00 for working equipment, instructions, and valuable sales plans. Satisfaction guaranteed or money promptly refunded. Alfred-Hermansen, 210 Fifth Ave., Suite 1102A, New York 10, N. Y.

\$25 WEEKLY Working two hours daily. No canvassing. No manufacturing. Lycke, Box 2471-A, Cleveland 12, Ohio.

POPCORN And potato chip equipment. Long Eakins Company, 5060 High, Springfield 99, Ohio.

WANTED Unused U. S. postage stamps, small discount. Advance Stamp Co., 24 East 23rd St., New York.

CO-PUBLISH And advertise in The Central Mail Advertiser. Sample copy 10c. Low rates. Large circulation. Bagby Printing Co., Georgetown, Ohio.

EARTHWORM Breeding. Valuable bulletins on successful methods mailed free. Earthmaster Publications, Dept. 14, Sun Valley, Calif.

LIQUID Marble—Colorful, glossy! Molded, brushed, sprayed! Cast novelties, statuary, colored tiles. Flexible molds. Composition floors. Particulars free. Marbleizing Service, Edwardsville, Illinois.

EXTRA Money. No selling; operate vendors. Amazing profits, details free. Silver King, Suite B, 622 Diversey, Chicago 14.

UNPAINTED Bookends, plaques, statues, figurines. List. Haverly Products, 1219 8th Ave., Altoona, Penna.

RESILVER Mirrors at home. Formula 25c. Ideal Service, Park Ridge 8, Illinois.

HOW To set up and run a mirror shop! Resilver mirrors. Make chipped glass nameplates. Electroplating salts and rectifiers. John Sprinkle, V60, Marion, Indiana.

CASH For your idea. 280 manufacturers need inventions, patented or unpatented. List free. Invention Bureau, 208M Clinton, Oak Park, Illinois.

MAKE Money making new greaseless doughnuts at home on electric machine. Wholesale to grocers, drug stores, cafes, hamburger shops. Send for free recipes and plans. M. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

RECAST Old batteries into new. Latest achievements. Battery Laboratories, Minneapolis.

READ "Advance"—The voice of mail order. Offers money-making opportunities, sources of supply, personal guidance, etc. Issued monthly. Sample copy 25c. Yearly subscription \$2.00. Advance Publishing Company, 313 East 21st Street, Suite 450, New York 10, N. Y.

START Mailorder bookshop—Everything furnished. 25c brings booklet, samples, exciting ideas. General Publications, Ossining, N. Y.

OPERATE Profitable mail order business. Write Walter Service, 4159-A East 112th, Cleveland 5, Ohio.

WHOLESALE baby shoe mountings, equipment, supplies. Foster's, 1520 Ardmore, Chicago 26.

MAILING Postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordan Publishers, Box 23, Pawtucket, R. I.

137 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 220 Grand St., New York 13.

BRUSH Plating outfits connect to a battery. No tanks necessary. Good paying business at home plating autoparts, bathroom fixtures, bicycles, reflectors, silvering mirrors. No shop or experience required. Outfits furnished. Free booklet. Gunmetal Co., Ave. H, Decatur, Ill.

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

MONEYMAKING OPPORTUNITIES

EARN Money by mail like I do. Literature free. Satterfield, Box 345-C, Mansfield, Ark.

BECOME A mail order specialist. Write J. M. Stenger, 500-20th St., Rock Island, Ill.

BARGAINS. New and used arc welders. Electric or gas engine, a.c. or d.c., all sizes, portable or stationary. Write needs. Hobart Welders, Box M-904, Troy, Ohio.

NEW—Different plan assures success in pleasant, profitable home-operated mail business. Write: National, Box 88-H, Boston 22, Mass.

MAKE Money in mailorder. Beginner's guide 25c. Ad-Man Dankmeyer, 2631B Guilford, Baltimore 18, Maryland.

CHURCHES, Organizations, agents sell candies. One pound tins only. Ralph Missimer, 251 Chelton, Philadelphia 20, Penna.

MAKE Back-yard profits! Unusual opportunities! Interesting booklet free. Pickett's, Florence, Kentucky.

\$50,000 RADIO Jackpot, other fabulous prizes anyone can win! 3c stamp. National Contest Bulletin, Box 2685-P, Miami 16, Florida.

WIN Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609 1/2 East 5th, Duluth, Minn.

NEW Profitable home business repairing zippers. Thousands of customers waiting. No experience required. We furnish everything. Write Texas Specialty Company, 204-B Texas, Texarkana, Texas.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Advertise. Argyle 1, Wisconsin.

EARTHWORMS. Complete culture, 150 hybrids and free plans Allweather Worm House, \$1.60 postpaid. William Barnard, 2121 Vanderbilt Lane, Redondo Beach, Calif.

CANDY-Making. Well paying home business. Amazing instruction course with formulas. \$1.00. Nelko, Box 3462-C, Chicago 54, Ill.

SCHOOL Seniors—Sell classmates America's most beautiful graduation name cards. Largest selection. Highest commission. Outsell all others. Free sample kit. Printcraft, Dept. M, 1425 E. Elm St., Scranton 5, Penna.

DOLLARS In personalized baby record books. Sell by mail. Use same literature we do. No-Co-Ro, Oakland 6, Calif.

LEARN The profitable and fascinating art of electroplating baby shoes at our expense! Write for details to manufacturers of world's largest assortment of plating mounts, equipment and supplies. Dept. W1, Hollywood Bronze Supply, 6141 So. Wentworth Ave., Chicago 21, Illinois or 1766-70 North Vermont Ave., Hollywood 27, Calif.

CONCRETE Birdbath, metal molds. New high daily production system. Gardenware, 404 Stitz, Louisville, Ky.

HOW To sell. What have you? Enclose \$1.00 for personal report. 35 years experience. Smith Advertising Company, Excelsior Springs, Mo.

EARN Big profits in mail-order. Let our long experience show you how. Small cost. No experience necessary. Lucious, P608 So. 18th St., Philadelphia 46, Penna.

MEN'S Ties \$2.50 dozen. Watches, jewelry, cookware, silverware, appliances, etc., lowest wholesale prices. Complete list 25c. Kriston Sales, Pemberville, Ohio.

NEW Fountainflow toothbrush. Jewelry, leather goods. Free wholesale list other hot sellers. C & C Sales, Box 578-P, Chicago 90, Ill.

START Own business, spare time, home or shop, make polishes, soaps, cosmetics, etc. Dollar brings fifty formulas, Star Enterprises, Box 21, Brooklyn 14.

BOOKKEEPERS Boost income operating simplified bookkeeping service. Kern, 4942 Vineland Ave., No. Hollywood, California.

BUY Wholesale—Million articles. Supply source directory, dime. Free samples, hundreds of advertised items. Supply Source Directory 25c. Nelko, Box 3462, Chicago 54, Ill.

CHURCHES, Ladies' clubs receive \$130.00, 12 tables. You sell advertisements for tables. Unique Gift Club Plan, Pine Hill, New Jersey.

INDEPENDENT Income! Make leather belts, billfolds, purses. Big catalog and genuine steerhide keyholder, 10c. Tandy Leather, Box 397E, Tulsa, Okla.

QUICK Profits taking magazine subscriptions, handling greeting cards. Cassell Publishers Service, Westfield, N. J.

BUY Nylons direct from mill. Make good profits on fast selling nylons. Quick delivery on any quantity. Write for confidential wholesale price list. Joy Hosiery Mills, Delawanna 13, New Jersey.

MAKE And sell a proven item welcomed by smokers like I do. Details free. Thos. W. Moeck Laboratories, 40 Wood St., Camden 2, N. J.

RAISE Your business value, standing, as state notary public. Information, Stationers, Helotes 50, Texas.

EASY Ways to earn extra income are described in Money-Making Hobbies, 132 projects you can make at home and sell anywhere. 160 pages, \$1.98. Popular Mechanics Press, 200-MH East Ontario, Chicago 11, Ill.

\$250 WEEK Reported! Free illustrated book "505 Odd Successful Businesses." Work home! Expect something odd! Pacific-E. Oceanside, California.

DOLLARFUL Ideas for you every month in advance—"Voice of Mail Order." Leads the field in exclusive supply sources. Plans for mail order operation; new products, etc. Details free. Advance Publishing Company, Suite 350, 313 East 21st Street, New York 10.

PUBLISH Your own magazine. Hand-some 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits, 25c brings sample, details. National, Ord, Nebr.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

FORMULAS, PLANS, ETC.

PRODUCTS Analyzed. Improved. Guaranteed formulas. Consulting Scientific Company, Swarthmore, Pennsylvania.

MAKE—Sell cleaners, soaps, polishes, flavors, cosmetics. No machinery. Formula literature free. Kemico, Park Ridge 16, Illinois.

AUTO Liquid wax, costs 14c pint. Money maker. Formula \$1. Plastics, Box 1574, Boston 4, Mass.

WATERLESS Hand cleaner. (No ammonia.) Easily made. Good profit. 2 dependable formulas \$1.00. Nelko Chemical Service, Box 3462, Chicago 54, Ill.

10,000 FORMULAS And trade secrets. Free literature. Stillman, 555 Kingston Ave., Brooklyn 3, N. Y.

TESTED Formulas. Interesting descriptive booklet free. Pont, Box 635-PM, Terre Haute, Indiana.

FORMULAS For nearly everything. Catalog free. Write Creative, Winnetka, Ill.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

PLASTICS

PLASTIC Consulting services to small businesses. Inquiries welcomed and answered promptly. 65 East Rich Street, Columbus 15, Ohio.

LEARN To cast plastic letters for personalizing gifts. Particulars and samples including your three initials, two dimes. A. H. Dreher, 2232 Brockway, Cleveland 18, Ohio.

NEW Liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for exciting new home project manual showing how to get started. Castolite, Dept. K-101, Woodstock, Illinois.

NU FLEX Heavy duty molding compound, new, plastic compound makes molds overnight. Economical. Plastercraft, 359 Third St., San Bernardino, California.

PLASTIC: Sheets, cut pieces, and scrap in clear and colors. Rod, tubing, acetate, dyes, jewelry findings. Send \$1.00 for 4 pound scrap assortment and fabricating manual. Regal Plastic Supply, 720 Main, Kansas City, Missouri.

AMAZING Liquid plastic kit \$3.25. Embed photographs, keepsakes, coins, make solid objects, clear, colors. Beautiful results in half hour. Easily tooled. Inexpensive hobby. Send 15 cents for catalogue. Kristalon Plastics, Dept. Z-90, Box 29, Wilmette, Illinois.

MOLD Makers—Attention! Genuine natural latex for reproduction of figurines, statuary, plaques, etc. Instructions free. B. M. Barron, 77 Francis St., Everett, Mass.

LUCITE, Plexiglas, acetate, 85 different colors, thicknesses. Immediate shipment from stock. Rod, tube, casting plastic. Wholesale, retail. Catalog, instructions, bargain lists, 10c. Gem-O-Lite, Box 586S, North Hollywood, Calif.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", 98c; 1/8", \$1.25; 3/16", \$1.52; 1/4", \$1.80. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Ave., New York 1, N. Y.

INTERNAL Carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Bound Brook, New Jersey.

EARN Money with plastics. New book, "Money-Making Hobbies," shows you how. 160 pages, \$1.98. Popular Mechanics Press, 200 E. Ontario, Chicago 11, Ill.

PLASTIC, Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

CHEMISTRY

COMBINATION Offer: Chemical balance, experiment book, catalog of laboratory supplies, \$1.00. Catalog only, 10c. Rex Laboratories, 2849-A Birchwood, Chicago 45, Illinois.

ATOMIC Calculator (Vinylite) — 96 elements. Atomic weights, valences, symbols, etc. Useful laboratory instrument, \$1.00. Sloyd-Rul Company, Box 603, Brooklyn 1, N. Y.

NEW Idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biological and laboratory supplies in small quantities. Catalog 15c. Established 1931. John H. Winn, 1244 West 23rd Street, New York 11, N. Y.

NEW Catalogue of laboratory chemicals and apparatus 10c. Luther Laboratories, New Britain, Connecticut.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology, 10c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, 20, N. Y.

AGENTS WANTED

MAKE Money easy. \$5.00 for selling only ten 21 Christmas card boxes. Also metallic and plastic cards, personalized cards and stationery, note paper and wrappings. Send for samples. Howard P. Ellis, Dept. PM-9, Pitman, N. J.

BE A money maker. Represent magazines year around. Wonderful home work. Big Christmas profits now. Liberal commissions. Everything furnished. Write for free catalog. McGregor Magazine Agency, Dept. 500A, Mount Morris, Ill.

NEW Antifog prevents windshield fogging. Distributors, jobbers wanted. Sample 25c. Pankey Co., 3731 Wascanna, Hapeville, Georgia.

\$50.00 EASILY Made in spare time. Sell sensational new name-imprinted Christmas cards, 50 sell for only \$1.00. Not obtainable elsewhere. Big profit. Write for free samples. Kit on approval. Regal Greetings, Hazel Park 76, Michigan.

FOUND! Over 100 ways to make extra money and friends. Sell metallic Christmas cards, wrappings, children's books, gifts. Big profits. Bonus. Request feature samples on approval, free samples name imprinted Christmas cards, stationery, napkins, free catalog and free selling guide. New England Art Publishers, North Abington 257, Mass.

CASH In on plastics! Big profits with our 350 new plastic home needs. Perfect for party demonstrators, canvassers, stores. Lowest prices—highest quality. Write for free details. Durever, 2781-G Atlantic Ave., Brooklyn 7, N. Y.

SELL Watches. Free details. Saro Watch, AB-1674 Broadway, New York 19.

PERFUME At less than wholesale. Write "Imco," 6347 Parnell PMA, Chicago 21, Illinois.

SHINE Shoes without "polish." New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee 154, Akron, Ohio.

AT Last! Something new and sensational in Christmas cards. Show gorgeous satins, velours and metallics never before offered. Gets easy orders fast! Pays up to 100% cash profit. Free samples of 30 Christmas cards with name, 50 for \$1.00 up. 80 assortments. Personalized book matches and stationery, gift items. 2 assortments on approval. Write Puro Co., 2801 Locust, Dept. 040-L, St. Louis, Mo.

BRAND New! Amazingly different and smart Christmas cards bring you big money! Take easy orders for sensational new Christmas cards. Pays up to 100% cash profit. Christmas cards with name 50 for \$1, up. Big line. Personal stationery and book matches. Get sample assortments on approval. Imprints free. Write today. North Star, 31 Glenwood, Dept. L-13, Minneapolis, Minn.

FAST Profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Holiday Co., Dept. M-9, 15-19 Pennington, Passaic, N. J.

AMAZING Offer—\$40 is yours for selling only 50 boxes Christmas cards. And this can be done in a single day. Free samples. Other leading boxes on approval. Many surprise items. No experience needed. Free samples personalized Christmas cards, stationery, napkins. Write today. It costs nothing to try. Cheerful Card Co., 1617 White Plains, N. Y.

TO \$35.00 Weekly. Spare time, home operated profitable mail order business. Successful small "beginner's" plan. Lynn, 5710-M Bankfield, Culver City, California.

SELL "NuSilver Plating Liquid." Cloth applied. Renews silverware like new. Silverplates brass, copper. NuSilver, 508-PM9 N.Y. Street, Aurora, Illinois.

BARGAINS! Save up to 50%. Hosiery, lingerie, toys, school supplies, blades, novelties, carded goods, drygoods, cosmetics, stationery, jewelry, notions, perfume, soaps, etc. Send 10c for illustrated 1000 bargain catalog. Valuable surprise gift free with first order. Reliable Jobbers. 311-B North Desplaines, Chicago 6.

NYLON Uniforms. Immediate delivery. Immediate profits. Sell to doctors, dentists, nurses, waitresses, beauticians, housewives. Free sales kit. Superior Fabrics. Dept. P9, 3936 Market, Philadelphia 4, Penna.

EARN \$3 Hour spare time—Sell Sunshine's beautiful, exclusive Christmas cards. 21 nationally famous French folders, \$1.00; 24 evergreen cards, 24 lined envelopes \$1.00; 50 imprints \$1.25. Many more. Samples on approval. Write for Sunshine's complete sales kit, free imprint folders. Sunshine Art Studios, Dept. PM-9, 115 Fulton Street, New York 8, N.Y.

LOOK Here! Wanted—Men to start in business on credit. Sell some 200 farm-home products. Thousands our dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. I-192-PPM, Freeport, Ill.

IMAGINE—Extra cash for you! Sell friends amazing value metallic, felt applique, comic, 50 for \$1.00 Christmas cards. Exclusive gift wraps. All-occasion assortments, scented stationery, animated books, gifts. Profits to 100%. Special offers. Bonus. Write today for free samples name imprinted Christmas cards, napkins, stationery, feature assortments on approval and free catalog. Elmira Greeting Card Co., C-2309 Elmira, N.Y.

ANYONE Can sell Hoover DuPont Nylon Uniforms for beauty shops, waitresses, doctors, nurses, others. In white and colors. Exclusive styles. Top quality. Low priced. Exceptional income. Real future. Equipment free. Write fully. Hoover. Dept. H-100, New York 11, N.Y.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 5624, Cincinnati 3, Ohio.

MEN Over 40. Sell guaranteed family shoe line direct from Brockton factory. Immediate commissions. Bonuses. Free selling outfit teaches you how to build permanent income. Mench Shoes, ME-27, Brockton, Mass.

\$50 YOURS. Sell only 100 boxes beautiful Xmas cards; also 50 and 25 for \$1 imprinted; others: novelties, metallics; stationery, write now for approval samples, cost nothing to try. Pen-n-Brush, PM-9, 139 Duane St., New York City 13.

SCHOOL Seniors! Your postal will bring our wonder, Kwick-Sell cardalog of popular graduation name cards. Biggest profits! Only firm giving free souvenir chest and card case. Don't miss out! Hurry that postal! Craftcards, Box 235 (L), Pittsburgh 30, Pennsylvania.

MAKE Money for yourself or organization. Sell big value Christmas, everyday assortments, wrappings, stationery, gifts, deluxe personals to friends, others, 100 items. Amazing profit. No experience necessary. Special offers. Extra cash bonus plan. Write today for samples on approval and exciting details. Hedenkamp, 361 Broadway, Dept. PM-9, New York.

SELL. Ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c, sells 35c. Make money. 15 samples \$1.00 postpaid. Lowy, 812 Broadway, Dept. 561, New York City 3.

CALL On friends with sensational Christmas cards in handy assortments. Sell for \$1.00. Profit up to 50c. Also popular-priced personal Christmas cards, everyday assortments, stationery, gift items. Samples on approval. Wallace Brown, Dept. N-4, New York 10, N.Y.

CASH In on tremendous demand for new low priced burglar alarm for cars, homes and farm building. Nothing like it. Everybody wants one. 286% profit. Unique sample offer. Northwest Electric Co., Dept. I-10, Pukwana, S. Dak.

NEW Bathroom deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 155, Akron, Ohio.

BIG Money selling tooth powder. J. Walker, 633 Plymouth Ct., Dept. 1, Chicago 5, Ill.

SELL Gold embossed Christmas cards, napkins, matches, coasters, 50 for \$1 imprints. Samples free. Dunbar, New Brunswick 1, N. J.

FREE Samples, and amazing plan giving you gorgeous dress without penny cost. Rush name today with dress size. Harford, Dept. C-335, Cincinnati 25, Ohio.

MEN! Say good bye to money worries. It's easy to sell tested merchandise with money-back guarantee. No high pressure. No novelties. No gadgets. Take orders for things everyone wants and needs: Men's shirts guaranteed to wear a full year. Men's pants. Women's slips with laboratory-tested seams. Lingerie. Uniforms. Nylon hosiery. Men's and women's raincoats—All guaranteed! Make quick profits with America's fastest-growing agents' line. You keep commissions. We deliver and collect. Get immediate cash, extra gifts and big Christmas bonus. No experience necessary! Big free sample catalogue. Rush name on penny postcard to Crane Tested Fashions, 547-M Broadway, New York 12, N.Y.

CASH Waiting for you! Collect big advance commissions selling exclusive cork-cushioned shoes. Free outfit and selling guide. Concordian Shoes, G-4, West Concord, Mass.

SILICONE Auto polish—Make, sell this new wonder. Amazing profits. Easily made. No machinery. Guaranteed formula \$3.00. Kemico, Park Ridge 20, Ill.

NYLONS Direct from mill. Sample free. Guaranteed against runs. No experience or money needed. Also nylon slips, briefs. Earn big money spare or full time. Become manager, appoint agents. We pay you 40c for every \$1 your agents earn. Sell 14K neckchain "Ourblat" \$6, cost \$2.50. Ergim Co., 992 Columbus Ave., New York.

\$2 FIRE Extinguishers, locally, mail-order. Lorrac, Box 1086-K, Albany 1, N.Y.

BUY Thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 1420-A Investment Bldg., Pittsburgh 22, Penna.

WAR Boom demand. Power mowers, '31 models. Gas-electric. Rotacut, R-2019, Excelsior Springs, Mo.

MEXICAN Feather pictures. Sell on sight; 200% profit! Free details. Sample 10c stamps. Sylvia-PF, Apartado 9036, Mexico City.

SELL New automatic floor waxer. Trigger on handle. Hands never touch floors or wax. Retail \$2.95. Profit 125%. Write Smith, Inc., Greenfield 34, Mass.

NOVELTIES And household items! Fast sellers for agents, dealers and gift shops. Write for 16-page Sunshine catalog. Sunshine Sales, Dept. WP4, Loudonville, Ohio.

NEW Items! Fast sellers! Big profit! Large selection includes: Men's wallets, ladies' wallets, carry-alls, costume jewelry, cigarette lighters, handbag atomizers. Perfect gift items for men, women, children. Write for free illustrated catalog. Ermo, Dept. M, 507 5th Ave., New York 17, N.Y.

BUSINESS Cards \$1.60 thousand postpaid. William F. Maloney, 91 Avondale, Rochester 7, N.Y.

SCHOOL Seniors—Earn sensational profits selling classmates America's most beautiful graduation name cards. Largest selection. Outsell all others. Free sample kit. Printercraft, Dept. M, 1425 E. Elm St., Scranton 5, Penna.

EXCELLENT Sideline—No selling. Inquire Modern Technical Supply, Dept. PMA, 55 West 42nd Street, New York 18.

CHRISTMAS Cards: Sell personalized cards, 50 for \$1.00 up. If you live west of Mississippi write for sales kit on approval. 100 assortments to make money. Imperial, 496 So. Main, Dept. P-11, Los Angeles 13, Calif.

EARN Big money taking orders for attractive boxes of Xmas cards, 50 for \$1.00 up. Also metallics, plastics, wraps, children's cards and books, name-on stationery, napkins, etc. Samples on approval. Call, write or phone. Rainbow Greeting Cards, 38-T E. 1st St., New York 3.

BRITISH Imports—Sell world's most beautiful stationery (free samples), fine perfumes, etc. Kenneth Boyce, Indian Orchard, Mass.

FREE Catalog, fast selling novelties, lowest prices. Hansen Sales, Dept. P-1, 2851 Madison, Chicago 12.

NEW Plastic rayon towels selling rapidly everywhere with spectacular demonstration. Large profits. Sample package \$1.00. Sunbeam Products, 634 4th St., South, St. Petersburg, Florida.

FREE Sample nylon stocking of world's only nationally advertised hosiery line actually guaranteed against runs, snags or excessive wear, regardless of cause! It's amazing but true. Every weight from sheerest 15 denier to heavy 70 denier—all gauges to luxury 60 gauge. Amazingly low prices, starting at \$1.00 prepaid for sheerest 15 denier 51 gauge. Not sold in stores. Good Housekeeping guarantee seal. Also complete line men's hosiery guaranteed one full year or replaced free. Full variety lingerie in crepe, satin and nylon, featuring all nylon slip at \$2.95, satin slip at \$1.58, etc. Housecoats and robes. Kendex sales people will earn one million dollars this year. Get your share. No money or experience needed. Pay nothing now or later. Just show free outfits. Write orders. We deliver and collect. Advance cash plus huge bonus. Earn money spare or full time. Become manager; appoint others to sell for you; earn steady income on their sales. Man or woman—young or old, you can earn more money than you ever thought possible. Everything you need is furnished free and prepaid, including nylon stocking, samples of materials, sales books, 36-page salesmanual, color cards, etc. Simply write your name and address on postcard and mail to Kendex Corporation, Babylon 63, N.Y.

FAST Profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write the Holiday Company, Dept. M-7, 15-19 Pennington, Passaic, N.J.

AS Seen in Popular Mechanics August issue—Amazing! New! Clip-on screw driver; holds the screw; demand is terrific! Low prices insure fast sales. Big profits. Write B. J. Johnson Co., 848 Wood Ave., Bridgeport 4, Conn.

SELL Dress fabrics to friends, neighbors. Stylish, beautiful materials. Year round profits. No experience needed. Free details. National, 640 Broadway, Dept. M, New York 12.

MEXICAN Feather pictures. Unusual novelty \$1.00 (stamps) brings \$2.00 worth samples, details. Refunded if unsatisfied. Aztec Art-P, Apartado 762, Mexico City.

AMAZING 1950 Personalized 50 for \$1. Christmas cards. Everyday cards, stationery, napkins, dolls. Other wonderful values. Samples on approval. Plateless, 392 Broadway, N.Y.

BIG Bargains for big profits. Over 100 sensational values. Men's used suits \$2, pants 35c, topcoats \$1.25, overcoats \$2, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-A Jefferson, Chicago.

SAVE—Make money. Buy merchandise wholesale. Free details. Orysen's, 1147 Sun-kist, Waukesha, Wisconsin.

MAGIC Cleaner—Laundry soap deal. Hotter than a firecracker. Big profits. Sample free. Bestco, 4642 No. Central, Chicago.

QUICK Money—Sensational Christmas cards, plastics, metallics, stationery, napkins. 50 cards with name \$1. Approval sample. Torres, 373 A-Fulton St., Brooklyn 1, N.Y.

\$85 WEEKLY Selling 4 pair shoes daily direct. Free outfit. Samples. No investment. Experience unnecessary. Advance commissions, bonus. Paragon Shoes, 739 Columbus, Boston, Mass.

REPEAT Sellers. Big demand. Profitable. Parker Drug Co., Hoboken 8, N.J.

FREE Samples. Big profits showing amazing Glow-in-the-Dark specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N.Y.

CHRISTMAS Card agents. Sell America's only \$1.00 Gift wrap assortment containing 30 full size sheets; giant plastic pencil containing personalized pencils; Santa stocking with name; Rudolph, the red nosed reindeer assortment. Over 100 Christmas card box assortments and surprise items. Write today for five free portfolios of personalized Christmas cards. Elmercraft, Dept. 13, 5930 S. Western, Chicago 36.

1950 XMAS Card catalog ready! Earn more money as a wholesale jobber! Large selection of dollar box assortments, imprints, religious, personalized Christmas cards! Three dollar sample boxes \$1, postpaid! Write for free holiday bulletin. Elfko, 438 North Wells, Chicago 10.

DRESSES, 18c; Coats \$1.00, blouses 35c. Free catalog. Crown, 164-P Monroe Street, New York.

FREE Outfit, write today! Sell embroidered advertising uniforms and work clothes, initial buckles, belts, badges, 2000 emblems. Hook-Fast Co., Box 480PM, Roanoke, Virginia.

DRAW Side income under notary public appointment. Stationers, Helotes 50, Tex.

WRITE for free booklet and catalog telling how to earn substantial profits in your spare time by forwarding new and renewal subscriptions to all magazines for your friends and neighbors. Oldest U. S. agency. Established 1869. Moore-Cottrell, North Cohocton, New York.

SELL Balloons! Combs! Novelties! Excellent sideline. Carleton House, Texas City, Texas.

NEWEST Money making sensation. Sell personal initialed belts, buckles, cap and breast badges, tie holders, etc. Choice 2000 emblems. Write sample outfit offer today. Hook-Fast, Box 1425PM, Providence, R. I.

JEWELRY Factory desires salesmen, distributors, jobbers. Pickcraft, 19 Bank Street, Attleboro, Mass.

SELL Big money-maker to men and women. Easy handwork makes fast-selling useful articles. Sunmade Company, Brockton 64, Mass.

GOLD Lacquered window sign letters. Large sizes penny each. New fells. Absolutely beautiful. Free samples. Atlas, 544 W. 79th, Chicago 20.

AGENTS: Stamping names on key protectors. Sample 25c. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

PHOTO-Salesmen-agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

AGENTS—300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

HIGH-GRADE SALESMEN

MEN, Women—Wonderful career opportunity with leading advertising line. New calendars, specialties, signs. Continuous selling season. Daily commissions. Re-orders credited. Deluxe sample outfit. Selling experience essential. Established 1892. Highly rated. The Harrison Company, Union City, Indiana.

REPRESENT America's finest and largest line of personalized gift and advertising specialty good will builders—includes the best in calendars, pencils and specialties of all types. LeRoy representatives are big money makers. We want a man in this area who likes and knows selling and wants to represent a company known for its fair treatment of field men. Write giving age, experience, etc. LeRoy, Inc., 2109-P Summit Ave., Union City, N. J.

CAN You use \$20 extra next week? Many make much more right around home, part-time. Get free outfit, tested comfort shoe selling methods. Write today, give shoe size. Mr. N. Lee, Desk CS-55, Consolidated Shoe System, Chippewa Falls, Wisconsin.

SALESMEN—Sell America's finest, biggest line of advertising specialties. Sensational sellers to all types of business. Big commissions advanced. Sensational sales plan nets you top earnings. Free outfit. Charms & Gain, 407-MP South Dearborn, Chicago 5.

EASY Dollar plan—Quick success. Sell exclusive advertising address books, card cases, combs, emery boards, handy purse kits, pencils, rulers, salad sets and thumbtacks. Highest commissions. Instant cash. Free sample kit. Lederer Ad Gifts, 1250 W. 33 St., New York.

SALESMEN. Earn \$50.00 weekly, selling only three pairs shoes daily. Commission and bonus. Wide variety for men, women, children. No investment. Experience unnecessary. Free catalog. Tanners Shoes, 665, Boston, Mass.

MAKE \$3,000 Next 90 days—Nationally advertised item. Price protected. Merchants need, increases business 80%. Commissions advanced. Outfit free. Schubert, 330-A South Wells, Chicago.

ILL Send you a fine suit and start you in a big money business in your home or office. Get your made-to-measure suit without cost taking orders at direct-from-factory prices. Big commissions. Splendid outfit with samples. Tested plans. Top men make up to \$9,000 in a year. Write Manager, Dept. 27, Box 23, Cincinnati 6, Ohio.

DISTRIBUTORS Wanted! Sell Lazy Man's Polish, the world's best for autos, furniture, windows. Everybody a prospect. Send \$1.00 for two full size containers with complete money making sales plan. C. F. Lusk Co., 5921 Bonna Ave., Cleveland 3, Ohio.

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-950, 7530 Greenwood, Chicago.

SOUVENIR Giveaway—Salt shakers. Terrific for driveways, taverns. Imprinted 2c. Full size. Ellsworth's, Pueblo, Colorado.

HOTTEST Money-maker out! New idea ironing pad pays you up to 100% profit. Saves housewives time, labor, money. Sells on minute demonstration. Fully guaranteed. Other sensational selling new household aids. Free sample offer. Sheldon, 1223 South 23rd, Dept. 507, Milwaukee, Wis.

\$6.00 CASH Every hour showing our sensational 3 in 1 deluxe folding shopping bag and purse. Women buy several. Commissions advanced daily. Sample furnished. LeNard, 179-D Washington, Chicago 2.

CALENDARS And advertising novelties. Full time or side line. Every business wants them. Few calendar salesmen are on the road now which means more sales for you. Fleming Calendar Co., 6539 Cottage Grove, Chicago 37, Ill.

POSITIVELY New—Over 100% profit. Two sided reversible neckties. Free details. Farrell Company, Dept. P-15, 1377 Van Zandt, Cincinnati 31, Ohio.

ADVERTISING Book matches \$6.95 per case. New sales plan sells every store! Regular commissions. Advertising specialties too! Morris Distributors, 404 North, Morris, Illinois.

SALESMEN—Sideline. Earn \$3,000 next 5 months selling calendars, advertising specialties. Buyers everywhere. Big commissions advanced. Samples free. Continental Calendar, 542-A South Dearborn, Chicago.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 17, Chicago 4, Ill.

EXCEPTIONAL Earnings selling famous Bostonian shirts. Spare time, full time, sideline. Sales kit, actual fabrics, free. Bostonian, 89 Bickford, Dept. A-10, Boston 30, Mass.

BIG Money taking orders. Shirts, ties, socks, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

EDUCATIONAL AND INSTRUCTION

IT'S Later than you think! G.I. training will soon be over. Inquire about training for job opportunities to make your future secure. Don't risk losing your veteran's entitlement. Factual information free. Write Box B4393, W.P.H.I., Chamber of Commerce Building, Pittsburgh 19, Penna.

BECOME A Doctor of Psychology or Metaphysics. Teach secret of contentment, happiness. Win degree of Ps.D. or Ms.D. Solve mental worries. Free book. College of Universal Truth, 5153-C North Clark, Chicago.

GRADUATE Watchmakers! Reach an untapped source of profitable new business in chronograph watch repair. Easy step-by-step Essembl-O-Graf method taught in GI-approved 22 week resident course or by low-cost home study plan. Be the first in your community to display the handsome Certified Chronograph Technician's diploma. Complete information on request. Western Pennsylvania Horological Institute, Desk B-93, 706 Smithfield Street, Pittsburgh, Penna.

BE A real estate broker through home study or classroom instruction. Write for free book. Approved for veterans. Weaver School of Real Estate, 15 E. Pershing Rd., Box CP-9, Kansas City 3, Missouri.

GOOD Jobs and a sound substantial future await in hotel and institutional field. Men and women, all ages, needed for well-paid positions that offer color, excitement, ever-new and fascinating duties. Record-breaking travel means even greater opportunities for trained men and women in hotels, clubs and institutions. Lewis School receiving calls for managers, assistant managers, stewards, hostesses, purchasing agents and 55 other types of important positions! From coast to coast there are important positions that offer splendid opportunities for advancement in a business where you are not dropped because you are over 40. Previous experience proved unnecessary! No need to leave your job to qualify. A good grade school education, plus Lewis Training qualifies you at home, in spare time. Our National Placement Bureau helps to place you—and our amazing Certified Job Plan—actually certifies you will "make good" when placed. Write today for free book! Veterans: Course approved for veteran's training. Lewis Hotel Training School, Room 80-368, Washington 7, D.C. (First and only School of its kind—now in its 34th year.)

INVESTIGATORS Trained, men-women, learn fascinating profession. Spare time study. Big pay. Folders free. Investigator, Box 490, Times Square Station, New York 18, N. Y.

AIRBRUSH Photo retouching at home. Send 25c for catalog. N. Y. School of Airbrush Art, 117 C East 60 St., New York, N. Y.

"HOW To Break and Train Horses"—A book every farmer and horseman should have. It is free; no obligation. Simply address Beery School of Horsemanship, Dept. 1106-C, Pleasant Hill, Ohio.

LEATHER Carving. Fascinating, highly-paid art; age-old secrets now taught for first time in home study course. For hobby, profession or profitable business, write: Baird School of Leather Carving, Box 1367-M, Dept. 19, Manitou Springs, Colo.

MAKE Up to \$35-\$45 week as a trained practical nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-9, Chicago.

SEE Our collection-credit business ad under Business Opportunities. Cole & Associates, Syracuse, N. Y.

AMAZE Your friends: Produce oil paintings at home. \$5 brings complete ten lesson course. Prickett's Petrel Studios, Box 49, San Diego 12, California.

READ With speed! New amazing method! Save hundreds of hours yearly. Free home test. No obligation. Rush postcard. Brownson, 9111 S. Hoyne, Chicago 20.

USED Correspondence courses and educational books bought, sold, rented, catalog free. Educational Exchange, Summer-ville, Ga.

DENTAL Technician's supplies. Artificial teeth, plastic, etc. Technician's manual. Grant Laboratory, 219 W. 7th, Los Angeles 14, Calif.

U. S. Civil service jobs! Start high as \$3,450.00 year. Secure positions. Men-women. Qualify now for many expected openings. Experience usually unnecessary. Free 40-page book shows jobs, salaries, sample tests. Write: Franklin Institute, Dept. J-24, Rochester, N. Y.

IT'S Fun learning a language by Linguaphone. At home, in leisure time, quickly, easily, correctly master Spanish, French, Italian—any one of 29 languages through proved Linguaphone conversational method. Send for free book. Linguaphone Institute, 83-P Radio City, New York City.

U.S. Gov't. jobs. Men, women qualify now. Study course, service helps you. Complete \$10. Wellwood Agency, Box 363, Oak Park, Ill.

BE A master salesman. Powerful secret key in new book, "How to Sell Faster." Send \$2.00 to Helpful Press, 2212 Cumming, Omaha, Nebr.

GET Photographic mind with Super-memory. Write Thor Books, M-9, Box 1210, Chicago.

IMPORTED Quality slide rules, log-log., decl.-trig. Bartro, 6605 Telegraph, Oakland, Calif.

NATIONAL Detective Academy. See our advertisement on page 26.

WORRY, Tension and fears knocked out or no cost. Free brochure and details. Write President Ballard, 1008 Washington Blvd., Louisville 2, Ky.

FAMOUS Singers; Secrets! Information! Free! Studio, 14356B Jersey, Norwalk, California.

GUNSMITHING—Learn for profit, pleasure! Practical residence course, day or eve, G.I. approved. Limited enrollment. Facts free! Pennsylvania Gunsmith School, 423 Federal, Pittsburgh.

LEARN Building design, or design your own home or cabin. Write Tech-Talk Design, 19375 Charleston, Detroit 3, Mich.

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USED Correspondence courses and books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Leo Mountain, Pisgah, Alabama.

HOME Study course, drugless therapy. Free literature. Institute of Drugless Therapy, Tama, Iowa.

INVESTIGATOR Training. Phillips Secret Service System, 1917-B North Keneth, Chicago 39.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "dollar-a-week" bookkeeping and tax service. Full or spare time. Details free. No obligation. Ellis, Box 200, Cedar Grove, N. C.

PIANO Tuning pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—52nd year. G.I. approved. Write for booklet. Niles Bryant School, 78 Bryant Bldg., Washington 16, D. C.

SECRET Investigation. Experience unnecessary. Investigators particulars free. George Wagner, M 125 West 86th, New York.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-J, Austin, Texas.

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ORIGINAL Musical comedy production. Three acts, twelve songs. Hilarious, unique. Suitable church or other organizations. Dorby Publishers, P.O. Box 738, Morristown, New Jersey.

I WANT New writers to cash checks of \$1 to \$100 offered daily. The easiest way to write for pay. No previous experience necessary. Free details. Saunders M. Cummings, 468-11 Independence Bldg., Colorado Springs, Colo.

INFORMATION

WHERE To buy most anything. We furnish supply sources. Single item, 50c. 3 for \$1.00. Service Bureau, Box 5053, Chicago 80, Ill.

BUSINESS SERVICE

INCORPORATE Your business. Delaware laws. Free details. Tax Research Bureau, Inc., Box 710, Wilmington, Del.

COMMERCIAL Representation New York vicinity. Personal commissions undertaken. Purchasing assignments handled. Manufacturers outlets available. Agency facilities maintained. Herman Brown Enterprises, 116 Mill St., Brooklyn 31, N. Y.

WHERE To buy it information, almost anything. Write, listing items. Kelly, 9544-D Whitcomb, Detroit 37, Michigan.

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FIVE Letters remailed from Daytona Beach for one dollar and source of supply furnished for Eremochloa Ophiuroides the new lawn grass for southern lawns that never needs mowing. T. Rule, PM 2240 South Peninsula Drive, Daytona Beach, Florida.

PHILADELPHIA, Pa. postmark! Letters and cards remailed from famous historic city. Intrigue your friends. Send 25c cash. (Also I sell beautiful original color postal cards of historic Philadelphia scenes, 10c each, 3 for 25c.) Evelyn Bedard, 7416 Castor Ave., Philadelphia 15, Penna.

FLORIDA—Reliable information any locality. Present facts on facilities, living costs, business, income possibilities. Write Charnell Information Service, 1843 First Ave., So. St. Petersburg, Florida.

INVESTIGATION And cash liquidation—Old or recent stock certificates, bonds, bank books, promissory notes, deeds, wills, insurance policies, financial documents of every description. Send us your list for appraisal. National Evaluators, P.O. Box 5852, Cleveland 1, Ohio.

MECH. Designing, drafting; from your sketch, machine, instruction. Professional work. Designers of America, Box 661, Lynbrook, New York.

PRODUCT And package design at unbelievable low cost! A complete art service, products, packages, labels, letterheads, layouts, etc., created. Make your product and merchandising material salable with finest and lowest cost design service in country. Write for free details. Products & Package Designers, 627 Grove, Evanston, Ill.

MECHANICS, Inventors, toolmakers. Prepare for coming production push. Get expert assistance with your metal problems. Heat treating information any type steel \$1.00. G. Firk, Metallurgist, 138 Thomas St., Utica 3, N. Y.

PHOTOGRAPHIC Missions accomplished. New York City. Confidential. Negative, print \$5.00. Anthony Todaro, Box #1096 G.P.O., New York 1, N. Y.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

ART—Learn to draw in spare time. Commercial art, designing, cartooning all in one course. Write for free book "Art for Pleasure & Profit." Studio C129, Washington School of Art, 1115-15th St., Washington 5, D. C.

AIRBRUSH Photo retouching simplified. 104 pages. \$1.75 postpaid. Harold Green, 117-C East 60 St., New York, N. Y.

FAMOUS \$75 Lockwood art course now only \$6 postpaid. Other smashing art bargains. Catalog 10c. Art Book Shop, Arnold 8-I, Missouri.

CARTOON Your way to success! Internationally known instructor, Raye Burns, will personally teach you to create salable, original cartoons at home. Course of 26 lessons only \$2.85. Send remittance with order or write for free details and addresses of successful students. Raye Burns School, Box 3583-M, Cleveland 18, Ohio.

ADVERTISING Artist teaches by mail. Particulars free. Joseph Bolger, 148 Concord, River Edge, N. J.

TALENT Test—Information. Give age. Art, Box 8066, Dallas 5, Texas.

CARTOONISTS Make big money! Draw cartoons for money. Complete beginners course in cartooning at exceptionally low price. Write today for free details. R. M. Seward, 1340A Susquehanna Ave., Sunbury, Penna.

ARTISTS, Sell your drawings. Informative booklet 50c. Box 2053, Colonial Heights, Virginia.

CARTOON Course—Monthly, 50c. Free details. 1437 North Highland, Los Angeles 28.

COMPLETE Course in cartooning. Simplified, easily followed instructions. Costs less than 8 cents a lesson. No money risk offer. Circulars, details free. Write Progressive Enterprises, 237 Bridge Street, Struthers, Ohio.

9 ALPHABET 3 Numeral pattern sets and catalog, \$1.00. Sign Letter Distributors, P.O. Box 101, Mineola, N. Y.

SIGN Painting taught at home. Test lesson free. Ben Kerns, Box 812-T, Greenville, S. C.

CHALK Talks. Laugh producing program. \$1.00. Catalog 10c. Balda The Cartoonist, Oshkosh, Wisconsin.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

WEEKLY Mailing lists: Mailorder buyers, opportunity seekers, etc., 1000, \$4.00; trial 250, \$1.00. Wright Publications, Memphis 8, Tenn.

MAILORDER Advertisement, 2,000,000 nationwide circulation, \$32.90 inch. 24-word classified, 20 Sunday newspapers, \$25.00. Instructive Ad-Guide—ratebook magazines, newspapers, mailing-lists—10c. Ideas developed. Ads prepared free. Chicago Advertising Agency, (Established 1900), Chicago 4.

CIRCULARS—Mailed first class mail 25c per 100. Israel Company, 6051-Y, Washington 5, D. C.

24 WORDS In 50 weeklies, \$4.96. J. Darrell, 730 Hays, Jackson, Tenn.

FREE! 1950 Advertisers Rate and Data Directory. 52 pages! E. H. Brown Advertising Agency, 20 N. Wacker, Chicago 6.

TRADEMARKS Designed complete with cut, \$10.00. Rough sketch, \$1.00. Catalog free. Burke, 3208-McKinney, Dallas.

CLASSIFIED Mailing lists. Details on request. Service Sales, Box 188, Detroit Lakes, Minn.

ADVERTISER: 24 Words, 40 newspapers \$3.50. Lists free. Advertising Bureau, 10511-C Springfield, Chicago 43.

MAILING Lists; \$5.00-1000 up. Write Dixie Service, King, N. C.

ADVERTISERS! Reach nearly 18,000,000 readers. 25 Sunday national key newspapers, 18 words, \$51.50. "Terrific pullers," 20 popular newspapers, \$10.00. "Free booklet." Special—One inch display 2-821,198 circulation, \$48.30. Newmark's Advertising Agency, (Established 1893), 217-7th Ave., New York 11.

ADS Placed in out of town newspapers and magazines. Low rates. Catalogue free. Ideas that pay. Baker Advertising Agency, Successors Ankrum Agency, 189 W. Madison, Chicago 2.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

TYPEWRITERS \$17.50, Adders \$12.50, duplicators \$9.95; addressers \$9.95. Typewriters, 118N Spruce, Wichita, Kansas.

REVOLUTIONARY Portable addresser. No plates. New! Sensational! Only \$9.95 complete! Fully guaranteed. Pru-A-Ex, Kingsport, Tennessee.

PRINTOMATIC Selffeeding post card printing duplicator \$13.50. Envelope addressing machines \$34.50. Pittsburgh Typewriter Company, 336-R Fourth Avenue, Pittsburgh 22, Penna.

RECONDITIONED Typewriters, printing devices. Write Dixie Service, King, N. C.

RUBBER STAMPS AND OFFICE SUPPLIES

RUBBER Stamps, 3 or 4 line, \$1.00 postpaid. Dealer proposition. Smalbod Printery, 2715 Vine, Cincinnati 19, Ohio.

3 LINES 45c; Pads 35c; signature \$2. Stamp-Right, Wauwatosa, Wis.

DELUXE Cushioned, indexed, knob handle; 3 lines 50c, 4-60c. Inked-pads 40c. Free literature, 500 two color gummed stickers 3/4 x 2" \$1.00. Quick service. Warner Stationery, Havre de Grace, Maryland.

READY Made stamps, free list. Criterion, Box 2326, Denver 27, Colo.

LINE 20c; 2-35c; 3-50c. Stamp Works, Auburn, Nebraska.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING GUMMED LABELS

MIMEOGRAPHING, Multigraphing. Like personal typing. Down low prices. Free samples. Packer, Box 1674, New Haven 7, Conn.

BUSINESS Printing. Samples, prices free. Howprint, 721-23 Eunice, Webster Groves 19, Missouri.

100 8 1/2x11 HAMMERMILL Letterheads and 100 envelopes \$1.85. Herbert Hudson, Centredale, R. I.

100 EACH Noteheads, envelopes, printed name, address, \$1.15. Gooch, 202PM, Hernando, Miss.

MIMEOGRAPHING By experts. Post cards, catalogs, circulars, etc. Free samples. R. Lasko, 8235R Chestnut, Philadelphia 39, Penna.

YOUR Printing our specialty. LaNan Press, 502 West Main Street, Richmond, Virginia.

MIMEOGRAPHING—Reasonable. Any copy. Malters Service, Box 606-A, Chicago 80, Ill.

100 ENVELOPES. Printed 2-colors \$1.25. Samples. Box 523, Rochester 2, N. Y.

PHOTO-Offset special, 5000-8 1/2 x 11 \$14. Samples free. Reiffe, 160-P Monroe St., New York 2.

FINE Printing. Offset, letterpress. We specialize in booklets, folders, publications, office forms. Send copy for estimate. Quality Printing Company, Richmond 20, Virginia.

125 LETTERHEADS (8 1/2x11 Hammermill) \$1.00 postpaid. Envelopes same. Race Printers, Hudson, New York.

DISTINGUISHED Embossed business cards, 1000 \$3.00 postpaid. Elmer Griffith, Seiotoville, Ohio.

\$5.95 THOUSAND Delivered. Letterheads, envelopes, statements. Honest service. Send your copy and remittance to Bixler, 754 Benson, Frankfort, Kentucky.

OFFSET Printing, 8 1/2x11—\$6.95 per 1000 delivered. Letterheads, letters, circulars, price lists, etc. Kale Bros., 2250 Milwaukee, Chicago 47.

1000 6 3/4" WHITE Wave envelopes \$5.00; #10 \$6.50. Postage extra. Ideal Printing Company, Hudson 7, New York.

1000 QUALITY High gloss business cards printed, \$5.00. Postpaid. Arrow Printers, 2212 Cumming, Omaha, Nebr.

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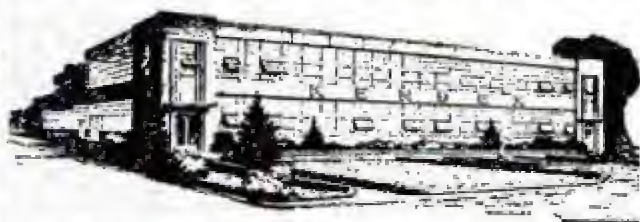


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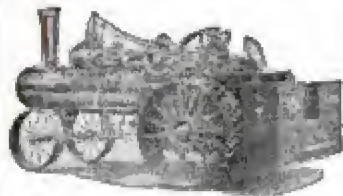


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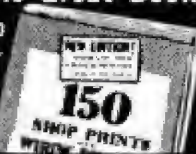
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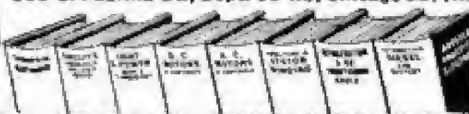
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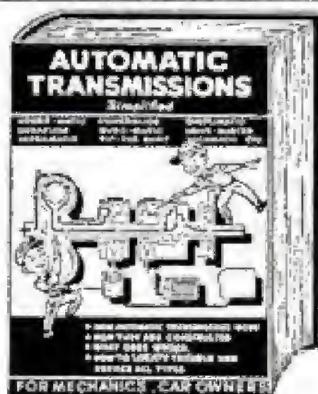
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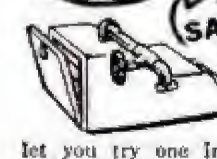
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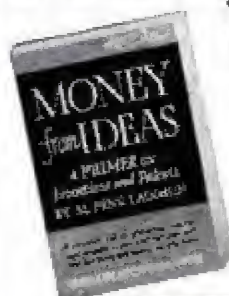
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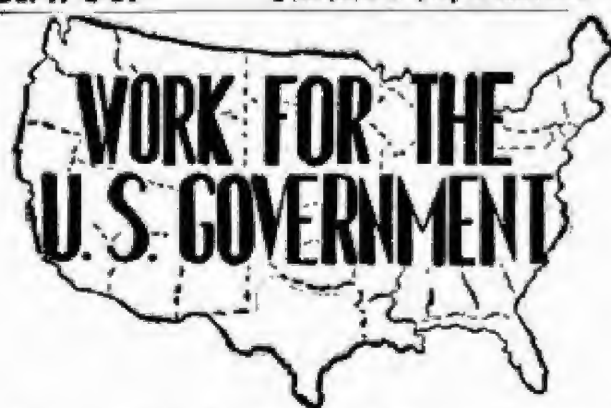
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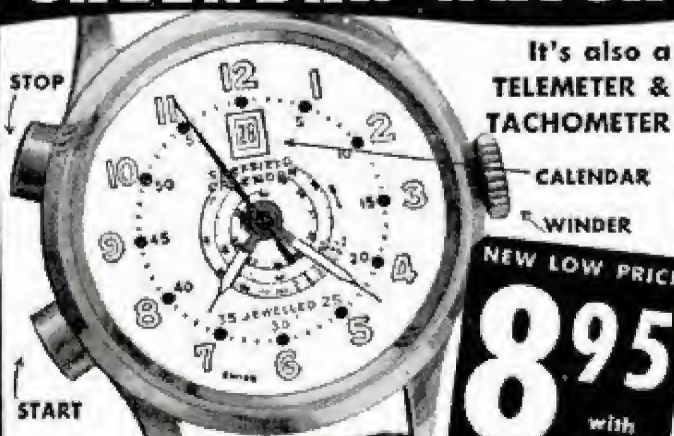
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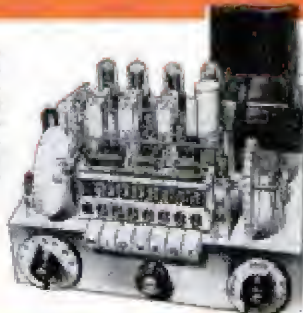
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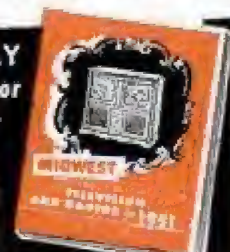
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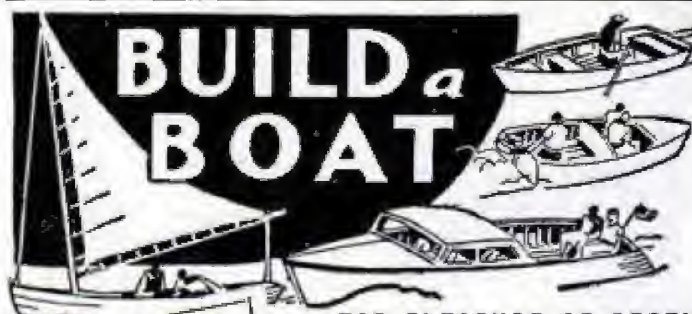
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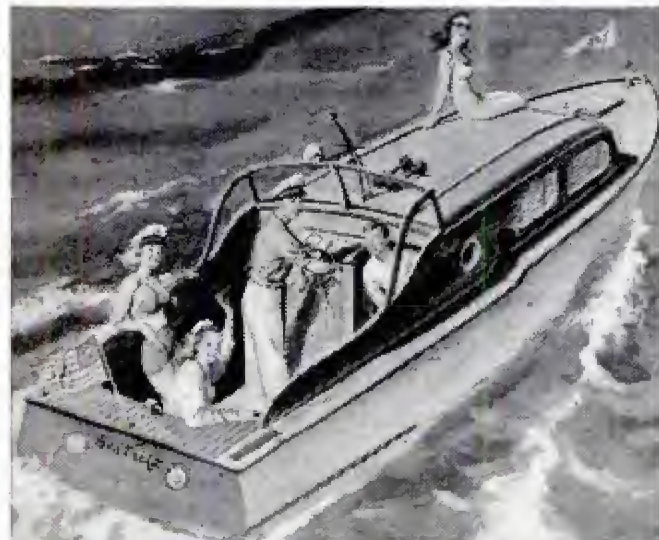
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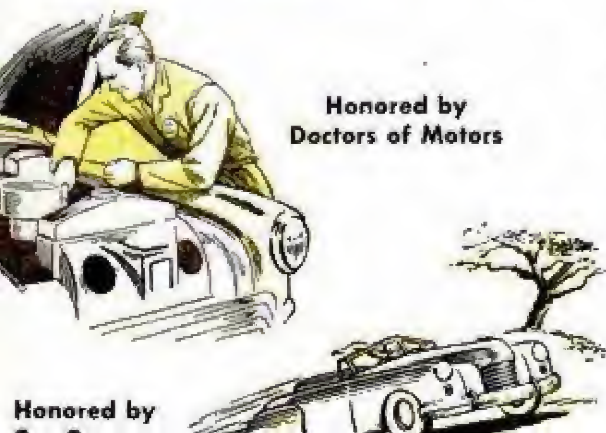
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Along a remote tropical stream in Venezuela natives pan for gold and diamonds with cone-shaped wood dishes

Treasure Hunt in a Lost World

By Richard F. Dempewolff

Part I

TALK OF GOLD RUSHES, boom towns where eggs cost \$1.20 each and coffee a dollar a cup, natural wonders like sheer mile-high cliffs with waterfalls to dwarf Niagara, the greatest ore deposits ever discovered, oil seeping from the sand at your feet, diamonds lying in surface silt to be dug by the shovelful—and it sounds like a wild-eyed saga of the '49ers.

Yet, today that saga is being repeated with flourishes. Airplanes are the "prairie schooners" that bring prospectors to their fabulous diggings. Weird "marsh buggies" with buoyant metal drums for wheels thump and splash over mushy hummocks of the 3000-foot-high plateau swamps, carrying cargoes of geologists and explorers into new unexplored regions in search of more oil, gold, diamonds and ore. Planes equipped with magnetometers comb the air and startle their owners with readings higher than any ever recorded. Jeeps, trucks and baby bulldozers flown into boom

towns that mushroom overnight on jungle-swathed river shores, are used to push through rivers that never saw a bridge, forests that never saw a white man. Many, like the covered wagons of the '49ers, bog down and are left to rot beside the trail while their owners forge ahead on foot in search of the "bomba," or strike, that will make them rich.

Miner wears his diamond-panning dish, or batea, on his head over his hat as he dreams of a big strike





Native woman tries her luck. One lad found diamonds worth \$5000 in five buckets of sand alongside river



These friendly Kamarakota Indians in eastern Venezuela have salvaged bucket seat of wrecked airplane

The scene of 1950's glittering frontier encompasses thousands of square miles of Bolivar State in that mysterious, remote corner of South America where the Lost World mesas of Conan Doyle rear their mile-high cliffs from equatorial jungles on the southeastern edge of Venezuela, near the Brazilian border.

Along the Rio Caroni, which has its

golden source in the clouds atop the southernmost mesas, and flows northward through jungle, across the Gran Sabana—as the Lost World highlands are called—out over the low-lying llanos grasslands and into the Orinoco, is without question one of the richest, most fantastic unexploited areas the world has known. When the conquistadores came there 400 years

While a pump sucks water out of a stream natives shovel muck from old potholes where diamonds are found





The Lost World region in southeastern Venezuela is one of the few unexplored or "white" spots left on map

ago, they found, besides jungles and snakes, Asiatic slant-eyed, squarely built highland Indians, with sturdy mountain legs set far apart. These were Taurepanes, and they told the ancient Spaniards wild tales of "little men" and strange beasts who lived atop the mesas, isolated there for centuries by the sheer walls. They told, too, of tremendous waterfalls born in the clouds, of rivers of gold and acres of glittery pebbles in the northern jungle river beds. On the llanos, they said, thick black water oozed from the ground, and some mountains spouted fire when the lightning came.

Jungle lore? Today, nearly every one of those tales is being proved a fact. From the side of Ayuan-tepui's (Devil Mountain's) sheer Lost World cliffs, almost a mile above a tangle of jungle, spurts Angel Falls, the world's highest waterfall, plunging more than twice the height of the Empire State Building for a total 3212 feet into the humid green vegetation below. Hidden deep in an eroded canyon, it has seldom been viewed by white men, and its source, a few feet below the mesa rim, is nearly always hidden by clouds.

What about the little men and strange beasts? "For all we know," says a Venezuelan who just returned from the area, "they may be. The Gran Sabana is studded with monster mesas, one to two

miles high, some of them 20 miles across and utterly unscalable. Who knows what's up there?"

Ayuan-tepui and Mount Roraima on the Brazilian border have been scaled by a few hardy souls. But the strange mountain tops are scarred with fissures from centuries of erosion that has carved them into weird shapes and made travel across the tops impossible. Jimmie Angel, veteran Venezuelan pilot and explorer who gave his name to the falls, flew his plane to the top of Ayuan-tepui in 1937, crash landed in a swamp near the rim and was unable to travel more than a few hundred yards in any direction. Angel and his party were rescued over the side with ropes. His plane is still there.

Aside from mesa-top fauna, the Indian tales are bearing furious fruit. Northward

Street scene in frontier boom town. A smart pilot flew in a generator and wire and now charges the miners \$6 per month for each light bulb





Here are 400 carats of Venezuela's finest diamonds under critical eye of appraiser for New York firm

along the Caroni and its tributaries, in primitive unexplored jungles, the gold is there—big nuggets and placer deposits which today are being by-passed for the more exciting glittery pebbles—diamonds—so profuse that little ones are thrown away by prospectors.

For 100 miles north along the golden river, where it meanders over the low-lying grasslands, are the black-water oil seepages. The fire-shooting mountains were discovered in the last two years, by both Bethlehem and U. S. Steel, to be huge mountains of the richest iron ore in the world, ranging from 55 to 72 percent pure. Lightning indeed strikes fire from these magnetic humps, which diamond drill cores have shown to contain a billion tons of ore.

Besides all this, the rich land, which produces basketball-size pineapples and range land to feed a world stock of cattle, hides tremendous deposits of bauxite that have never been touched.

Most recent and dramatic rush to Venezuela's fabulous frontier occurred this year, for diamonds. Last fall three Italian prospectors paddled a native dugout up and down Caroni tributary rapids, probing the ledges where jungle streams cut through eroded Sabana plateaus. Finally, one day in January, ragged, tired and ready to quit, they beached their boat on a sandy ledge. Compulsively, they trotted out their suruku—a circular, three-screened panning tray—and sifted a shovelful of stream-bed gravel. The top, coarse screen held a four-carat diamond! Between them, the other finer screens held 140 diamonds ranging to one-half carat in size. It was a \$4000 haul. Excitedly they stored the stones in empty pulverized milk tins and kept digging. When food gave out, they ate fish and game brought to them by friendly Indians from near-by grass-hut villages.

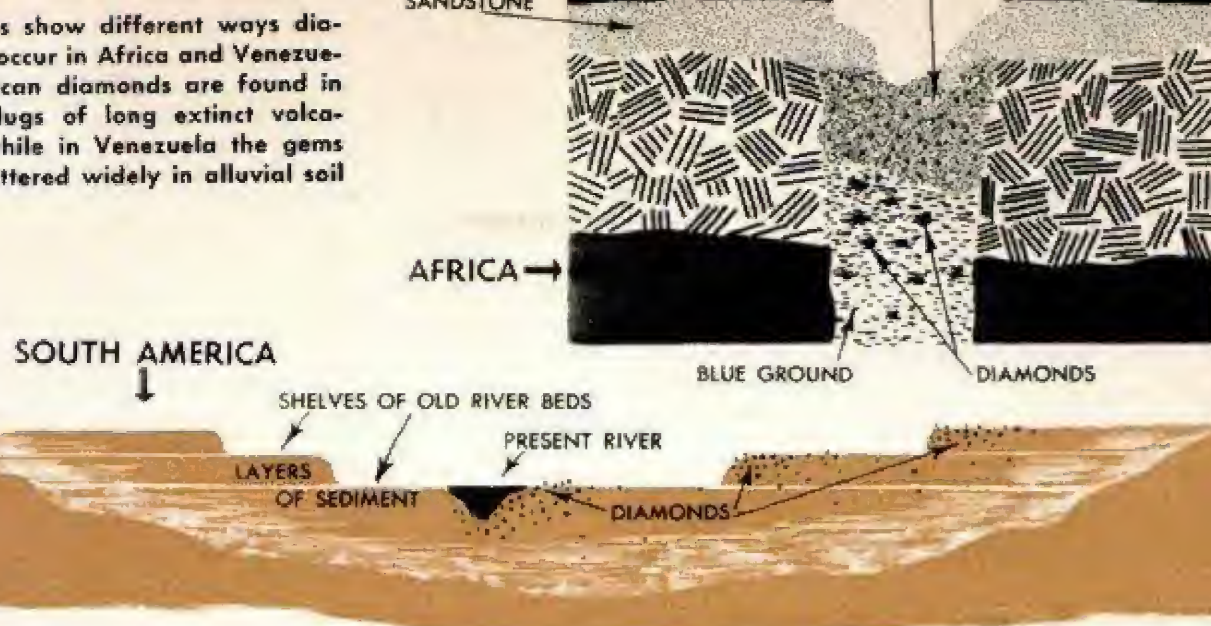
To catch fish, the ingenious natives take the stalks of native barbasco bushes, fray the ends like a whisk broom until the poisonous milky sap flows freely. With these they swish the water until it becomes cloudy with the poison. The fish are stunned, float to the surface and are shot by red-loin-clothed Indian boys with bows and arrows.

By March, the three prospectors had cleared \$120,000. As the news spread, the Uriman, as the area is known, swarmed with people pouring up the Caroni in small

The Gran Sabana—two-mile-high mesas rise from almost impenetrable jungle floor. Ayuan-tepui is at right



Sketches show different ways diamonds occur in Africa and Venezuela. African diamonds are found in lava plugs of long extinct volcanoes while in Venezuela the gems are scattered widely in alluvial soil



boats and rafts from outpost towns of Icaburu (which didn't exist last year, but now numbers 6000 souls), Guasipati, Peru, El Dorado. Wealthy folk flew in via Linea Aeropostal Venezolana from Caracas, Barcelona and even Brazil. A rickety boom town rose by the riverside, frontier gambling dens opened up, men went about armed but there was no thievery. Planes charged \$175 for the half-hour hop from Bolivar City on the Orinoco. Incredible strikes were made. "One 15-year-old boy," recalls a Caracan, "took five buckets of sand from a Caroni tributary and came up with \$5000 worth of diamonds in an hour."

Oddly, geologists don't know where Venezuelan diamonds come from. "In Africa," explains Dr. Frederick H. Pough, curator of mineralogy and geology for the American Museum of Natural History, "they are

in diamond 'pipes'—the feeder tubes of long-extinct volcanoes plugged with ancient lava. The diamonds are embedded in the lava plug, where they either crystallized as the lava cooled, or were carried up in crystal state by molten lava—no one knows which. As eons passed, the lava altered to a serpentine, then oxidized to blue clay and finally to yellow clay."

African prospectors look for these "blue ground" or "yellow clay" plugs by tracing diamonds up stream beds where they have been washed from their source.

But no one has ever found one of those old plugs in South America. Geologists assume that they must long have eroded away, for the diamonds are scattered all over the country in alluvial soil so near the surface that a shovel and suruku screen are all that's needed to dig them out in most

Cargo plane dumps out vital equipment and food on dirt airstrip at Icaburu during the recent "diamond rush"





Jeeps perform the jobs of bridges, busses and railroads in frontier country and command fancy prices

cases. Ancient beds of long-dried rivers have them; they are laid down in ledge after ledge of old peneplains carved by centuries of meandering streams. And every place you find diamonds, you find gold—not in veins, but in sediments. Even the great rearing mesas are not basaltic or crystalline rock, but tough sedimentary rock from which the softer sediments around them have eroded away.

But some people, like Jimmie Angel, gaze at those mesas with sharp eyes. "The rivers are carrying the gold and diamonds to the valleys from someplace higher up," they point out—"and that someplace must have a higher concentration of them." Angel has been flying in and around the Lost World for years looking for a lost river deposit of gold nuggets, which he swears an old prospector led him to many years ago on a mystery flight. Nobody laughs at him.

Exquisite gold work is a native Venezuelan craft. The orchid pin here is made of 22-karat Caroni gold



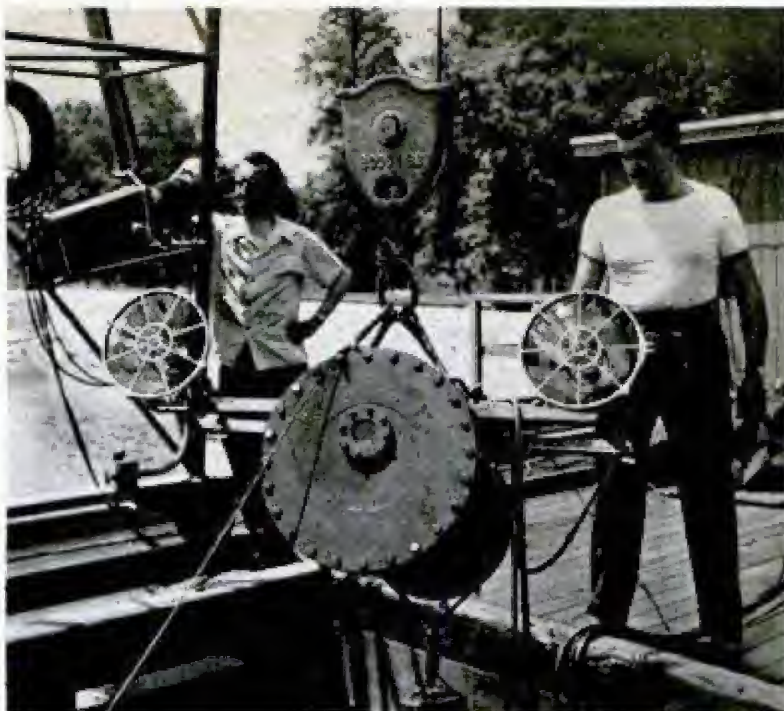
In any case, there are enough gold and diamonds on the 4000-foot-high Gran Sabana to keep up a steady stream of frontier "strikes" and rushes. The headwaters of the precipitous Caroni, weaving and rushing down from the highlands over rapids, has created numerous potholes—ideal catch basins for diamonds and nuggets. As the river has changed its course, these potholes have filled with silt. A "strike" is usually the discovery of a collection of such old potholes. It was in a similar place farther south, on the "River of Hell" in Brazil, that diamond-drunk prospectors once hauled a total of 23,000 carats of the stones in one afternoon. The place had been worked before, but the ancient potholes lay hidden beneath a concretelike conglomerate. A careless workman dropped a crowbar, broke the sediment and revealed the big find.

Few modern pieces of mining equipment have found their way into the jungle-bound Gran Sabana. The going is too tough. One New York diamond merchant lost a fortune trying to fly in a huge sifting plant. Native methods, some of them four centuries old, still are in use. Each miner stakes a claim, and starts carrying away the "overburden" or topsoil in big wooden bowls. When he hits diamond or gold-bearing strata, he gets out his batea—a wooden dish about three feet in diameter, shaped like an inverted Chinese hat. This is filled with a load of silt, and swished about in typical "panning" procedure. Lighter sand and gravel wash over the rim, while heavier gold and diamonds sink to the conelike bottom of the batea. Naturally, a lot of perfectly good gold and diamonds spill over, too, and are lost. "There's a curious superstition among natives," explains one old hand, "that it's unlucky to find both gold and diamonds in a batea. I've seen plenty of gold deliberately thrown back."

More modern and efficient than the batea is the suruku, a circular nest of three sieves, coarse, medium and fine mesh. The prospector shovels 30 pounds of sand and gravel into the topmost coarse screen, spins it in the water until all small grains of silt and gravel have washed through to lower screens. It is then denested and set aside, and the process repeated with the finer screens. The pebbles in each screen are picked over, and diamonds or gold nuggets are retrieved by hand. It's a long, grueling process, but men with diamond glitter in their eyes will work at it from sun to sun.

A few larger, more ingenious machines have been shipped in. On one Gran Sabana claim a group of men devised a big drum into which sand and water are thrown. The drum spins, by gasoline motor, churns

(Continued to page 240)



Department of Defense photos

TV for Deep-Sea Divers

Deep-sea diving operations can now be speeded and documented by means of a television technique developed by the U. S. Navy. The camera, inside a steel casing flanked by stroboscopic lights for underwater illumination, is lowered to the work-

ing area by cable. A relief diver on deck can follow the previous diver's progress and doesn't have to waste time orienting himself to the situation. Films made of the television, which is distinct enough to show the shock waves caused by a revolving ship propeller, preserve the operation for study at a later date.



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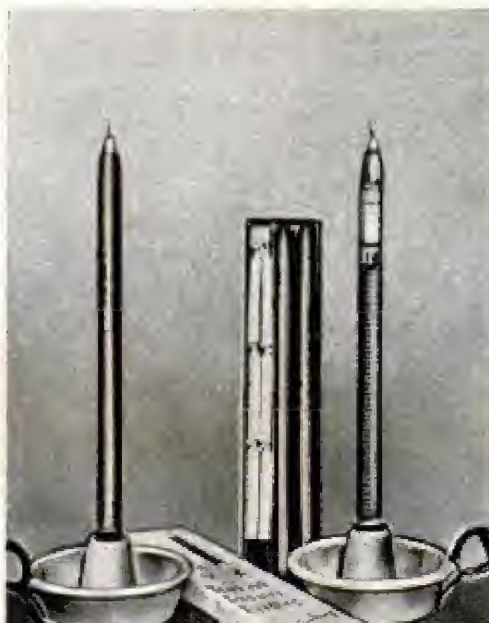


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CARPETS get fresh color right on the floor with a dye that you just brush in

CANDLES with wax refills are always tall, graceful and dripless. A spring raises the refill as it's burned away

TUB SEALER is flexible plastic in strip form. It eliminates water leakage around the tub and washbowl





SPOUT COVER fits standard screw-top jar for storing pantry supplies. Plastic lid seals tightly when spout is closed



DRY DEFROSTER scrapes frost from a home freezer, making melting unnecessary

SPUD BAKER holds potatoes on prongs that carry heat inside for faster baking



CARD TABLES are protected by a removable top that is washable and scuff resistant. It's reversible, both sides being finished with a colorful lacquer



SHALLOW-WELL PUMP is automatic yet so small it fits under the sink. No large storage tank is used. It lifts water 25 feet

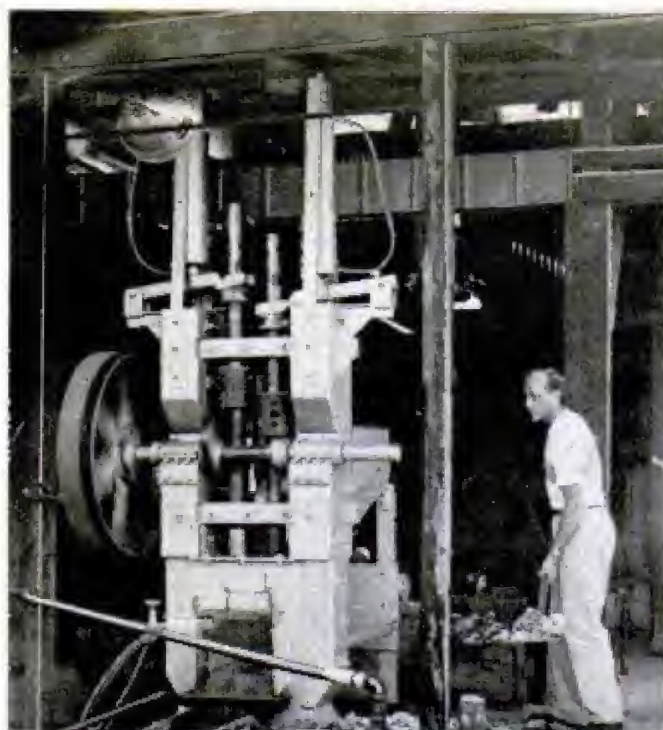




Dr. Geer demonstrates his TV system with enlarged model of screen. The prisms break light into colors

Prisms for Color Television

Color television of a new type has been developed by Dr. Willard Geer, director of physics laboratories at the University of Southern California. The system is based on the ability of prisms to break up light beams. Doctor Geer's television screen consists of a large number of tiny prisms. Three electronic "guns" beam the primary colors onto the prisms, which superimpose the colors on each other to give the viewer a natural color picture. The receiving tube can be installed in present black-and-white television sets, and will receive color televised by any of the systems that are now under consideration by the Federal Communications Commission.



Pneumatic Stamp Mill Designed for Prospectors

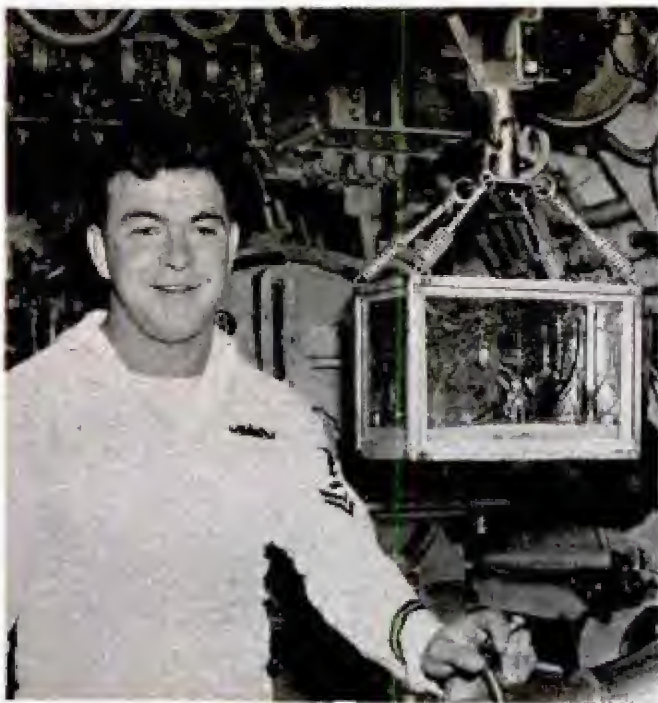
Although compressed air is used to boost the crushing action of a stamp mill, no compressor is needed. A small air tank is pumped to about 50 pounds pressure by an ordinary tire pump. This is enough air to operate the stamp mill for a week. The air simply acts as a booster for the stamps, eliminating the need for tremendous weight. There is only a slight loss of air because the up-and-down action of the stamps also acts as a compressor, returning air to the tank after each stroke. The advantage of the air-operated mill is its light weight and fast action. The small mill weighs only 500 pounds and a larger model weighs 1500 pounds, permitting transport into the mining area. The mills operate at 200 blows a minute for each stamp. The prospector mill will handle six tons of ore in 24 hours at 35-mesh screen. A five-horsepower gasoline engine runs the smaller model and a 15-horsepower engine the larger one.



Car Screen

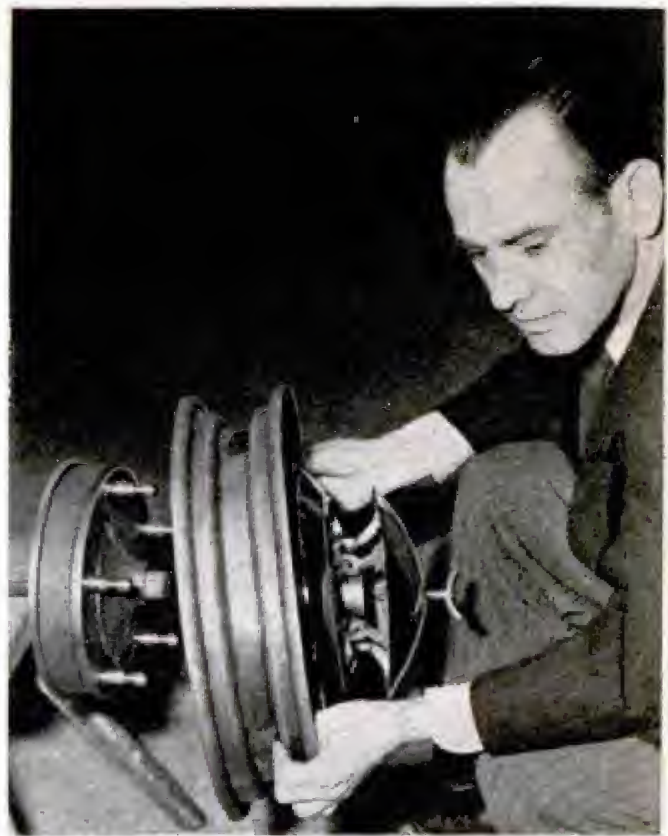
Sportsmen and tourists who sleep in their cars will appreciate the value of an adjustable screen that fits any car window. Mosquitoes and other insects are kept out without interfering with ventilation. No bolts or fastening devices are used, the screen being held in the window channels by means of three adapters.

¶ Only two states, Massachusetts and Rhode Island, are considered to be adequately mapped.



Aquarium in Submarine Takes Fish for Ride

Probably the world's most traveled tropical fish belong to Torpedoman William H. Jones of the U. S. Navy submarine Pickerel. The fish go wherever the Pickerel goes. Recently, they "swam" from Hong Kong to Honolulu, a distance of 5200 miles, in 21 days when the Pickerel completed the longest undersea voyage ever made. Jones' hobby is collecting tropical fish and he designed and built a seagoing suspension system for his aquarium. Rough water makes no difference to the tropical fish as they swim in their own quiet pool, thanks to a universal joint, coil springs and chains which keep the aquarium on an even keel.

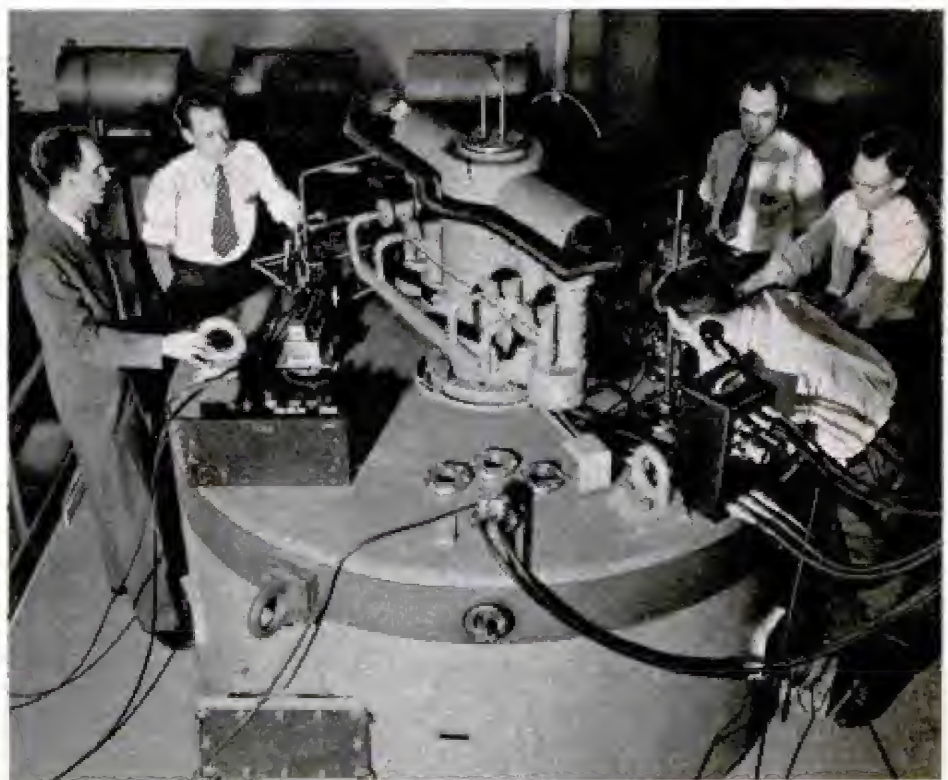


Quick Wheel Fastener

Even a child could change an auto wheel when it is secured by a new hub. The fastening has no lugs to tighten and requires no tools, once the wheel has been lifted off the ground. Developed by a German refugee, the wheel hub has five tweezerlike levers which clamp around five projections on the brake drum. The wheel is locked in place by pushing in the hubcap. The inventor says the faster the wheel moves the safer it is, because centrifugal force increases the grip of the lever arms.

Magnetless Atom Smasher

In this atomic age, new models of atom smashers come out as frequently as new automobile models and the latest is a non-ferromagnetic synchrotron that is expected to produce X rays of 300 million volts. This new particle accelerator has no huge iron-core electromagnet. Necessary magnetic fields are produced by coils of wire, carrying heavy current. The electrons move in a vacuum between the inner and outer coils, which accelerate them to generate the X rays when they strike the target.



General Electric photo



Golden palominos are leading the popularity parade and these two are trained to support a standing rider

Galloping **GOLD**

By Andrew Hamilton

Photos by Lucille Stewart

THERE'S a New Look in horseflesh—a color as rich and dazzling as a well-polished \$20 gold piece. Horses that sport these high-fashion, honey-colored coats, trimmed with white manes and tails, are palominos.

Beautiful color and shapeliness make the palomino a natural for leading parades adorned like royalty

You've seen them in parades, rodeos, fiestas and horse shows. In the middle 1930s, only a few such magnificent animals existed—but today the upsurge in interest among American horse breeders, fanciers and hobbyists has increased their numbers to approximately 10,000.

The palomino is a golden horse in more ways than one. Colts sell for \$500 and up. Mares bring \$1000 to \$5000. A fine stallion is worth \$10,000 or more and is difficult to purchase at that price. Even the matter-of-fact Western rancher, who has long operated on the theory, "We don't care about color if it's a good horse," has been compelled to recognize the current popularity of the palomino.

The golden palomino is often called "the most beautiful horse in the world." In recent years this superlative has been applied not only to his brilliant coat, but also to his carriage. He sometimes used to be jug-headed, raw-boned and as graceful as a milk-wagon nag. But careful breeding has developed in this animal gentle manners, a shapely head and a well-proportioned body. Leading a parade or prancing in a horse show, he's a sight not easily forgotten.

Perhaps the best-known palomino in the world is Roy Rogers' famous horse, Trigger. The movie-going public doesn't know it, but the Trigger you see on celluloid may be any one of Rogers' string of six or eight golden horses. Other members of the





Hydraulic lift eases horse-owner's job of raising or lowering heavy trailer hitches



Desert Gold, prize palomino of the Flying W Ranch, Pacoima, Calif., gets his valuable mane shorn with electric clippers

Hollywood horsey set who own palominos include Gene Autry, Alan Ladd, Spike Jones, Leo Carrillo and Bob Burns.

Many breeders are convinced that the palomino coat was developed by nature on the Arabian and African deserts thousands of years ago as protective coloring against the hot sun. When the Moors overran Spain, they brought golden horses with them—ancestors of the famous yellow Ysabellas of the 15th century and the golden horses of early Spanish California. During World War II, the Coast Guard used palominos to patrol the beaches because their light colors blended harmoniously with sand and rock.

There are many explanations for the origin of the word palomino. Perhaps the simplest and most logical is this: In the early days of California, one of De Anza's soldiers, Juan Palomino by name, owned a magnificent golden stallion. This animal was called el caballo de Palomino, "Palomino's horse."

In spite of their Arabian-Moorish-Spanish ancestry, the palomino today is bred and raised most extensively in the United States. Increasing interest in palominos is also shown by horse raisers in England, Canada, Mexico, Argentina, Venezuela, India, New Zealand and Australia.

The two American breeding centers are California and Texas. On the West Coast, palomino ranches are located principally in



Desert Gold prepares to enter the streamlined aluminum van in which he rides around country to shows. He wins many ribbons. Below, palomino proves that he can do more than look pretty





This palomino mare presented owner with golden colt which only happens about 50 to 85 percent of time



Power buggy for removing straw and debris from the stable travels 18 m.p.h. and carries 13 cubic feet

the misty coastal valleys of San Diego, Los Angeles and Santa Barbara counties. In Texas they are found in all parts of that huge state where horses are raised.

About 3000 American horse breeders belong to the Palomino Horse Association with headquarters in Reseda, Calif. One hundred Texans have their own Palomino Horse Breeders Association at Mineral Wells, Tex.

How does one get started as a palomino breeder?

Many horsemen do it the way Jim and Edna Fagan of Reseda did it. Jim saw his first golden horse leading a parade at the annual Santa Barbara fiesta in 1929. "I knew then that I wouldn't be happy until I had a string of palominos," he said. It was not until 1935, however, that the Fagans were able to purchase their first mare.

(Continued to page 234)

Below, Jim Fagan demonstrates intelligence of his palomino with a balancing act at night horse show





Motor Bike Fits in Back Pack

If a German motor bike breaks down along the road, you just fold it up, tuck it in a sack and carry it to the nearest garage!

It weighs only 15 pounds and is full size in every detail except the undersize motor. Hinged in the center, the bike folds into a compact package. The seat and handle-bar supports telescope for packing.



Portable Black-Light Source

Collectors of minerals, stamps and other objects can examine materials under ultraviolet light in broad daylight with a battery-operated black-light source that weighs less than two pounds. The instrument permits on-the-spot identification of minerals. Stamp collectors use it to study printing ink and postal cancellations. Gem quality can be determined by a study of fluorescence. Two standard flashlight batteries power the mercury-vapor tube.



Ski-Bob

Offering users the thrills of two sports is a combination ski and bobsled invented by a Bavarian. The frame is mounted on skis and steered by a crossbar. It is six feet long, with an ordinary bicycle seat about 14 inches above the ground.



Miniature Motorcycle

Utilizing all his spare time during the past four years, an English engineer has built a five-inch-high gasoline-powered replica of his own motorcycle. It has a spring frame, two gears, a handle-bar twist throttle and lights that work. The machine is 12 inches long and weighs 15 pounds.



Training Leash "Spanks" Dog When He Fails to Obey Order

Dogs quickly learn to heel when trained with a new leash that taps the dog on the head as he tries to break away. The leash is a short length of aluminum tubing with a stout leather handle. Attached to the base of the leash is a short extension on the end of which is fastened a length of spring wire terminating with a hollow ball positioned just above the dog's head. As the dog lunges forward to break away, the ball is jerked downward tapping the animal on the head and causing him to stop the forward motion. In a short time, the dog learns to remain beside the trainer even when the leash is removed.

"Sardine" Pack for Car Bodies Doubles Flatcar Capacity

By packing automobile bodies as compactly as sardines in a can, Kaiser-Frazer Corp. has doubled the number of units that can be shipped on a railroad car. The bodies are loaded horizontally on special

"pinwheel" racks which pivot to hold the 16 bodies vertically in two rows. The technique, developed in cooperation with the Union Pacific Railroad, not only cuts shipping costs, but reduces loading time.





DOCTOR FOR OLD TIMERS

By Merle E. Dowd

BACK IN 1610—340 years ago—a now-nameless European with a flair for fine craftsmanship fashioned a watch from whatever materials he could find. By present standards it was a crude mechanism. Only one hand swung around the face, for in those days time was not considered a priceless commodity and a watch that gained or lost only an hour a day was a miraculously accurate timepiece.

In the three centuries and more that have passed since the watch was assembled, the European craftsman has been forgotten but his work has ticked out the time of the ages. At some point in the world's history the mechanism broke down. A few years ago the watch fell into the hands of Dick Cole, a painstaking craftsman. Thanks to Cole, the old timer is ticking again.

To Cole, an assistant professor of mechanical engineering at Northwestern

Marvel of spacesaving is Dick Cole's "shop" in a bureau drawer. Watch-repair tools are at his finger tips. Below, musical roller plays five tunes in an old clock. Cole plans to put 18 tunes on one roller



University, time and its measurement have become a fascinating hobby. It is the centuries-old watch that intrigues him; a broken antique timepiece is a challenge. Putting a 300-year-old watch into operation somehow gives a man a new perspective on the tensions and worries of our own short days.

For years Cole has been rebuilding antique watches. Two years ago, though, destiny seemed to take a hand in his hobby when he crossed the path of a man named Leopold Metzenberg. For a lifetime Metzenberg, a Chicagoan, had been collecting old and valuable watches. On 40 trips to Europe he collected 570 watches, each a beautiful antique work of art. Trouble was, some of them wouldn't run.

Since then Cole has been busy rebuilding timepieces of all kinds: watches made almost entirely of wood; watches with striking bells and moving figures; diamond and ruby-studded watches built for royal families; complicated automatons; calendar and moon-phase indicators; watches that play tunes. Each is a different problem, and in each case Cole has worked with the same materials the original watchmaker used, or modern substitutes that have the same appearance.

In many of the timepieces, parts are missing. Then Cole searches through his library of rare books on timekeeping to discover how the watch originally looked and what materials were used. In some cases, he first has to make tools and dies, often more difficult to fashion than the parts themselves. Through his long association with watches, Cole has come to see time as an endless stream—he may take months or years to complete his work on one of the old timers. There's no feeling of hurry in Cole's workshop.

The shop itself is a miniature work of art. When Cole first started repairing old watches, he and his family lived in an apartment where there was no room for a conventional shop. Cole talked his wife out of one drawer of an old bureau, which he converted into a marvel of space-planning. The drawer pulls out and the hinged front drops down level with the bottom. Fluorescent tubes along the sides and back flood the workshop with light. Miniature racks hold the tools at finger-tip reach. When Cole finishes work for the night, he merely swings up the front of the drawer and shoves it into the bureau.

One of the craftsman's first projects was

Many of the ornate and valuable watches of the Metzenberg collection wouldn't run until Cole went to work on them. Here are just a few of the antique timepieces. Black line in photos represents one inch to show comparative size. 1—Carved gold watch, made in Madrid about 1850, strikes the time with a gong; 2—Bug watch for the lapel has black wings which fold over the face; 3—"Cuckoo watch" whistles a tune while bird moves; 4—French watch, made about 1800, is model of a medieval harp; 5—Figures on automaton watch keep time to a striking gong; 6—Large timepiece is one of few remaining watches fashioned by a master French watchmaker





In his neat-as-a-pin basement shop, Cole works on antique clock mechanisms and their carved wood cases

7—Bug, controlled by watch movement the size of a penny, pivots about ornate dial to show the time; 8—One of earliest German watches, made about 1600, has only one hand and looks like a miniature book; 9—Ornate watch has three cases to protect the fragile enameling, though the additional cases also are enameled; 10—Each number on this heavily carved gold watch is enameled on an individual plaque; 11—Floral enameling for man's pocket watch, so bright it almost seems luminous, is surrounded by a ring of tiny matched pearls; 12—Gold and rococo watch, made in Germany about 1785, is raised in relief and has a tortoise-shell case



7



8



9



10



11



12



Cole, at his shop drawer, has the patience of Eternity. He may work weeks over small part of casing

Music watch, rebuilt by Cole, has figure of a dancing girl, moving between two animated figures at sides

a wooden pocket watch. The main driving wheel was broken, though years before it had been patched with extra teeth. Links were missing from the driving chain, one of the few metal parts. The watch was originally carved from a dense, brittle wood with virtually no grain. Cole tried to match it for months without any luck, then finally hit on the idea of using a coconut shell. His library yielded a picture of the watch and he proceeded to carve a new back cover.

face of the watch presents a surprisingly animated scene—a man strums a mandolin, a woman claps her hands in time with the music and a girl dances between them. All the figures actually move and all are synchronized with the music from five bells inside the watch—real bells, not wire gongs.

Inside, some of the gear teeth were missing from the main driving wheel, carved from wood. He decided to use a plastic material the same color as the wood for repairs. Cutting the teeth exactly right so they would mesh with the wooden works required new tools, so he built a gear-tooth-cutting fixture for his jeweler's lathe.

When Cole took over the job the silver dancing girl was missing, the striking works had disappeared and two of the five bells were lost. He carved and hammered the figure of the girl out of bright silver, designed and built a mechanism for playing the bells and actuating the figures. He tuned two new bells to harmonize with the old ones, then rebuilt the mechanism to play a traditional tune. Now the figures come to life at the touch of a finger.

Next came a new driving chain, with links the size of a fine pencil lead. Each link had to be made by hand and drilled with holes so small it is difficult to see them. After nearly a year of part-time work the wooden watch was ticking again.

According to Cole there has been no major mechanical improvement in watches since way back in 1756. Our modern split-second timing is a result of improvement made in mechanisms known 200 years ago. The hairspring on the balance was the last major improvement. By the style and workmanship on a watch, Cole can tell approximately when it was built.

One of Cole's most difficult jobs was rebuilding an automaton watch, which has moving figures plus five striking bells. The

(Continued to page 226)

13—Magnified view of floral case shows detailed enameling. Gold wire outlines each petal and leaf to form a dam for the enamel; 14—Tulip-bulb watch, made about 1810; 15—Same watch, with bulb open to show dial





Detroit Listening Post

By Siler Freeman

THIS IS NEW-MODEL season in the automobile industry. Some of the new cars are ready for introduction, and but for the uncertainty of the international situation would shortly be riding the double-deck trailers to dealers' show windows around the nation.

What long-range effect the Korean war will have on the change-over to new models is impossible to gauge at this writing.

Designers and engineers have finished their work on the '51 lines. But the shot-in-the-arm which automobile sales departments call for may not be needed this year—demand has quickened tremendously because of the fear of shortages, first of steel, and then of finished automobiles—and it is quite possible that the manufacturers will avoid any shutdown of production for retooling so long as they can sell all the '50 models they can make.

Packard is already out with its offerings. The 1951 models, described more fully elsewhere in this issue, show a complete break with most of the traditions of the oldest company making cars, in looks, styling and even price class. Its three-passenger coupe in the lowest priced line, the 200, will seek business from not only other independents but will try to crash the barriers of the biggest producers.

Nash planned to introduce in late September its new offerings in the Ambassador and Statesman lines, and the Rambler sedan and coupe were due in December.

Pre-Korea calendars called for the big new-model shows late this year. If the major companies do go forward with the change-over, it is likely the 1951 cars will not be radically different in appearance.

At the recent tremendous rate of production, some buying resistance might eventually have been reflected in a downturn of prices. Car buyers have lost any hope for a reduction in the foreseeable future now, and the industry is watching the price of steel for a guide to the next trend in automobile prices.

With automatic transmissions showing little change in principle and design, the auto makers plan to concentrate on new engines for their next big drive. The en-

gine program has taken two paths, the first beaten by General Motors with high compression through V-type power plants of entirely new design, and the other as illustrated by Packard's new motor, using most of the old tools and attaining high compression through new heads.

The two trends are dictated primarily by economics. GM will have as disciples both Chrysler and Ford, as well as Studebaker. All of the latter have the money to put into new facilities and tooling.

The others, not so well financed that they can lay out many millions to bring out an entirely new engine, are following Packard. But the object of both programs is to give the customer the smoothness and power of high compression.

Chrysler is so enthused about its V-8 engine that even before it is in production, schedules have been doubled on it. Originally scheduled for 20 an hour, plans now call for 40 an hour. It will be made in the East Jefferson plant, with the DeSoto-engine production now housed there being moved to the DeSoto plant.

Meanwhile, the evident success of its Rocket engine has moved Oldsmobile to drop its 76, the six-cylinder model, from its schedule as of October 1. This has been coming for a long time. The 88 model, with its Rocket engine, has about cornered the market among Oldsmobile buyers and while schedules have been raised and raised, demand has been staying ahead. Even the 98 line has been cut back to make room for more 88s.

Oldsmobile's new assembly plant, opened only last spring, is being pushed to its utmost, even with the most modern equipment. Its original schedule of 80 cars an hour has jumped to 85 and S. E. Skinner, general manager, is eyeing the possibility of getting a few more out of the plant.

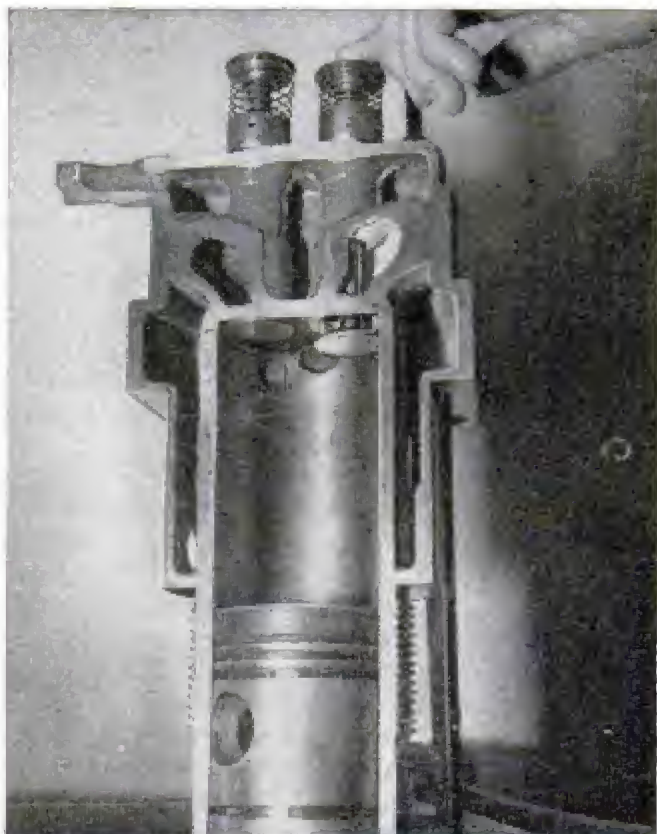
Kaiser-Frazer is watching the reception its Henry J. is getting from the public. It now has one line on its Kaisers, which are selling well, and the other turning out the smaller, low-priced car. If orders keep piling up, another line is available for the Henry J. A convertible will follow later in the same line.



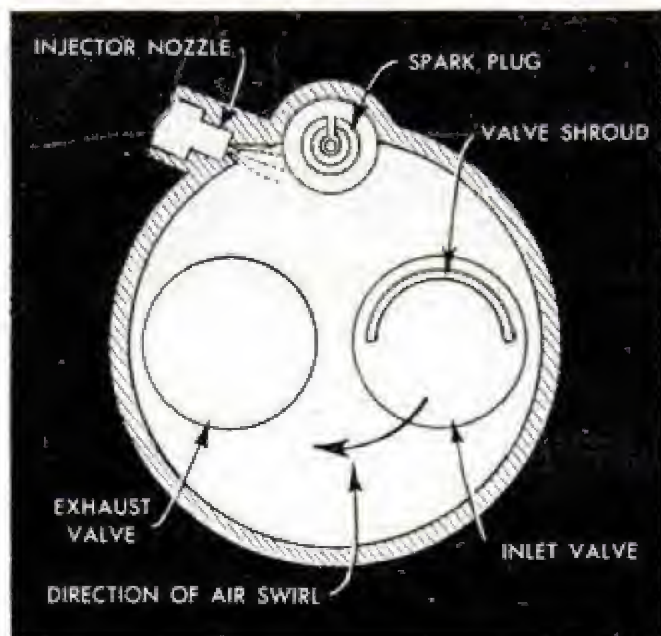
VALVE WITHOUT SHROUD—AIR ENTERS COMBUSTION CHAMBER, MOVING IN ALL DIRECTIONS



SHROUDED VALVE—AIR MOVES IN ONE DIRECTION ONLY



Cutaway shows no-ping engine cylinder. Below, tiny valve shroud creates a whirlwind inside the cylinder



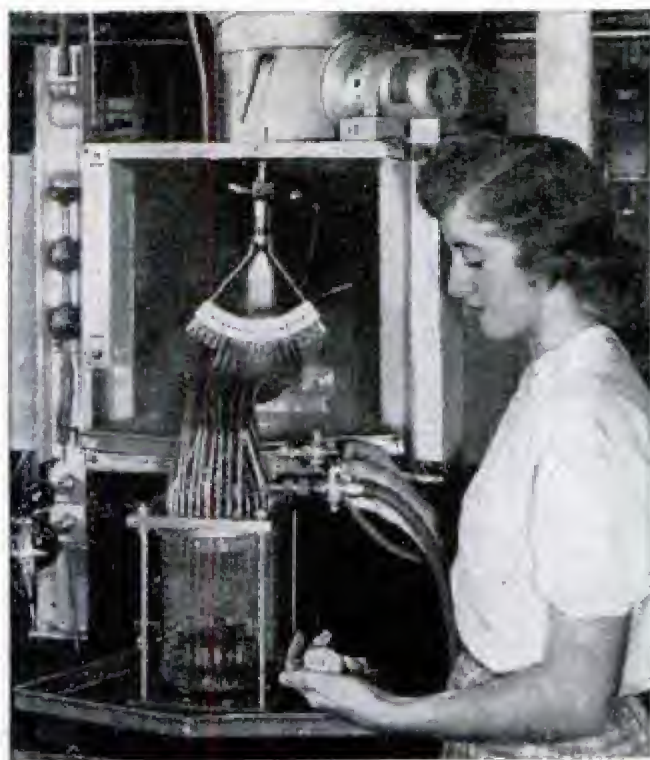
Engine With a Built-In Tornado

IMAGINE RUNNING out of gas on a country road, hiking to the nearest general store for a can of kerosene, then dumping the kerosene in the tank of your shiny new car with its high-compression engine, stepping on the starter and taking off like a jack rabbit.

Don't try it on your present car. You won't go anywhere. Even if you could get it started, the inside of your engine would look like the deserted end of a blackened, pock-marked battlefield after a few minutes of running. But in a few years, that dream may come true. Hidden up in the wooded hills above the Hudson River town of Beacon, N. Y., in the laboratories of The Texas Company, several models of an experimental cylinder sit on test blocks thrumming an almost unbelievable story.

"Alcohol, kerosene, benzine, motor oil, tractor fuel and many other fuels will work as well in it as high-octane gasoline," point out the engineers who designed the engine. "... almost anything from 90 octane to 90 proof," is the way one man cheerfully puts it, and he adds, "you might even get a sputter out of the engine using a high grade of after-shave lotion."

The engine is knockproof, and it is so



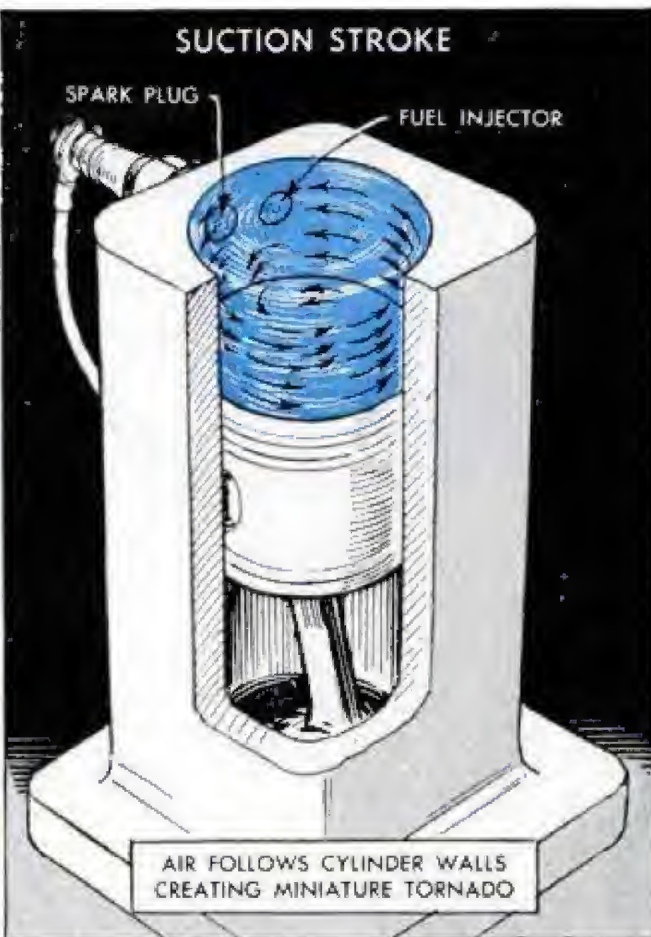
Laboratory technician tests various spray nozzles for the new engine. Fuel collects in test tubes and is measured to determine the efficiency of the nozzles

efficient that it will deliver an average of 30 percent more miles per gallon. With it, New York City taxi operators would save \$2,000,000 a year. The average car owner, driving 10,000 miles a year, would save about \$50 on fuel alone.

Secret of the new engine—called T.C.P. (for Texaco Combustion Process)—is a built-in tornado inside the cylinder, and a radical fuel injection and firing system. It all started about eight years ago when Texaco top brass set Everett M. Barber, a brilliant, husky young engineer, to work on the big bugaboo of the oil industry—engine knock, which has resulted in an ever-spiraling race to keep octane numbers ahead of higher and higher compression engines. "Every time the octane goes up a point," they explain, "it costs the industry more than half a billion dollars. Since the war, oil companies have parted with more billions to boost octane than it has cost to finance the Marshall Plan to date."

The ping and knock you hear on hills is what happens when the octane number is too low for your engine. And it can be more harmful than you think. It can send a spark plug up through the hood of your car if it's bad enough. A walk through the test stands where knock is investigated at the Beacon Labs sounds like a day at a gunnery range. They ran a high-compression truck cylinder for three minutes on a grade of fuel five numbers too low, one of the engineers reports, and at the end of that time it stopped dead, pitted and charred beyond repair. You can imagine what

(Continued to page 264)



Two strokes show action of the new cylinder, which operates even on kerosene. Above, as piston moves down, air swirls into cylinder. Below, at top of stroke fuel-air mixture ignites and burns completely





Drone, to which wire is attached, takes off from catapult. Over target its engine will be killed by radio and drone will parachute down with remaining wire

Drone Plane Lays Wire

SMALL radio-controlled drone aircraft are being used experimentally by the Army for laying communication wire, the idea being that the drones could do the job faster and more safely than a crew of soldiers in a front-line area. The wire used by the drones weighs one third less than World War II field wire and is coiled inside light canvas containers instead of on heavy metal reels. Each container holds half a mile of wire and the wire in separate containers can be joined. The containers may be carried on a Jeep for laying wire at high speed on the ground.



Canvas container holds a half mile of lightweight wire which unreels as the drone zooms toward target



Free end of wire is attached to the robot aircraft. A small radio-control box guides the plane



Three's No Crowd in TV Filming

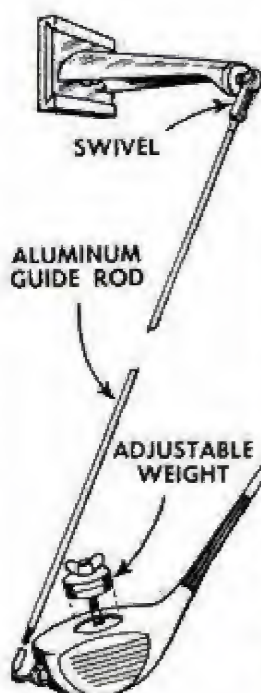
By using three cameras simultaneously to photograph half-hour shows for television broadcasts, the Jerry Fairbanks studio cuts production time down to three days. Two days are used for rehearsals and the third for shooting. Because the three cam-

eras are spotted for close-up, medium and long-shot views, the show is given variety by splicing the films. Once the film has been made, it can be shown over any number of stations, reducing the cost per showing considerably. Quality is said to be superior to the method of filming live programs from a TV tube for rebroadcasting.

Golf Aid Controls Swing

Golf players can improve their swing with a pendulumlike guide rod that controls movement of the club through the entire arc of the swing. The guide rod attaches to the club head on a ball-socket swivel and to a bracketed arm extending out from a wall or tree. Tests in a Miami, Fla., golf school revealed that the device helps the golfer bring the club head back low and straight along the intended line of flight, stresses the importance of a straight left arm and proper wrist breaking.

¶ When the dentist drills away on one of your molars, the tooth enamel undergoes an average temperature rise of 100 degrees.





U. S. Air Force photo

Triple-deck bunks gave the crew much-needed rest during a flight that lasted through two nights and a day

I Flew Thirty-One Hours

By Lt. Edward A. Timmins

1st Strategic Reconnaissance Squadron, USAF



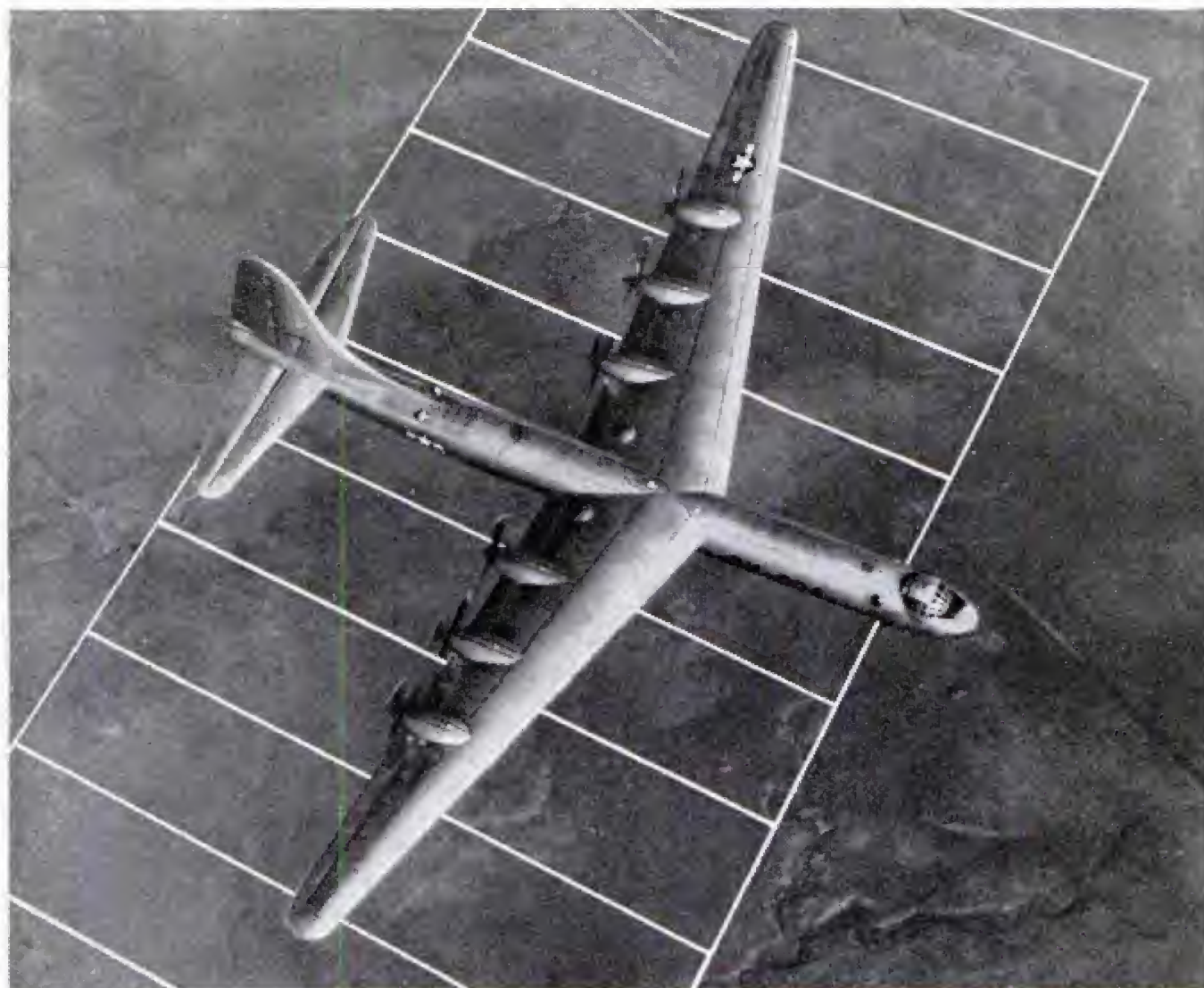
I SPENT two nights and a day several miles high in the air, on the first extreme-range reconnaissance mission to be flown in a Strategic Air Command B-36.

For 31 hours we crossed and recrossed the country without landing. Our giant six-engined plane flew some 7100 miles as we completed more aerial and radar photographic projects in one flight than could have been attempted in a fortnight just five years ago.

As radar bombing and photo specialist, I was just one of a crew of 22 aboard the huge aircraft, including extra men carried in several positions for training purposes.

Our route stretched from Fairfield-Suisun Air Force Base in California to the

The author, a radar bombing and photo specialist, flew on the first extreme-range reconnaissance flight



Consolidated-Vultee photo

Overhead view of the big B-36 shows how its dimensions compare with superimposed 100-yard football field

in a B-36

Georgia coast; then to the southern tip of Texas, to the Colorado mountains and back to our base near Sacramento.

The crew was composed of officers and airmen of the First Strategic Reconnaissance Squadron, the oldest unit of Ameri-

can air power. This outfit was organized as the First Aero Observation Squadron in 1913 and pioneered many of the reconnaissance procedures in use today.

This flight was not the longest we could have flown, but it was long enough to reveal some of the problems we will meet if called upon to fly 10,000-mile missions.

The B-36, to begin with, is a high-altitude, long-range plane, which is at its best at nearly double the heights which were considered high in the last war.



On the 7100-mile flight the plane flew from coast to coast and back again, with side trips along the way

Its wing stretches some 80 yards from tip to tip, being so thick that engineers can make inspections of engines from within, even in flight.

The wing is nearly twice the length of the Wright brothers' first flight at Kittyhawk. The pilot, sitting high in the nose, can hardly hear the engines, much less see them. Only the extremities of the wing are easily within sight from his seat.

Lateral spread of the tail assembly almost overlaps the wings of a Flying Fortress, which was the backbone of the bombing of Europe.

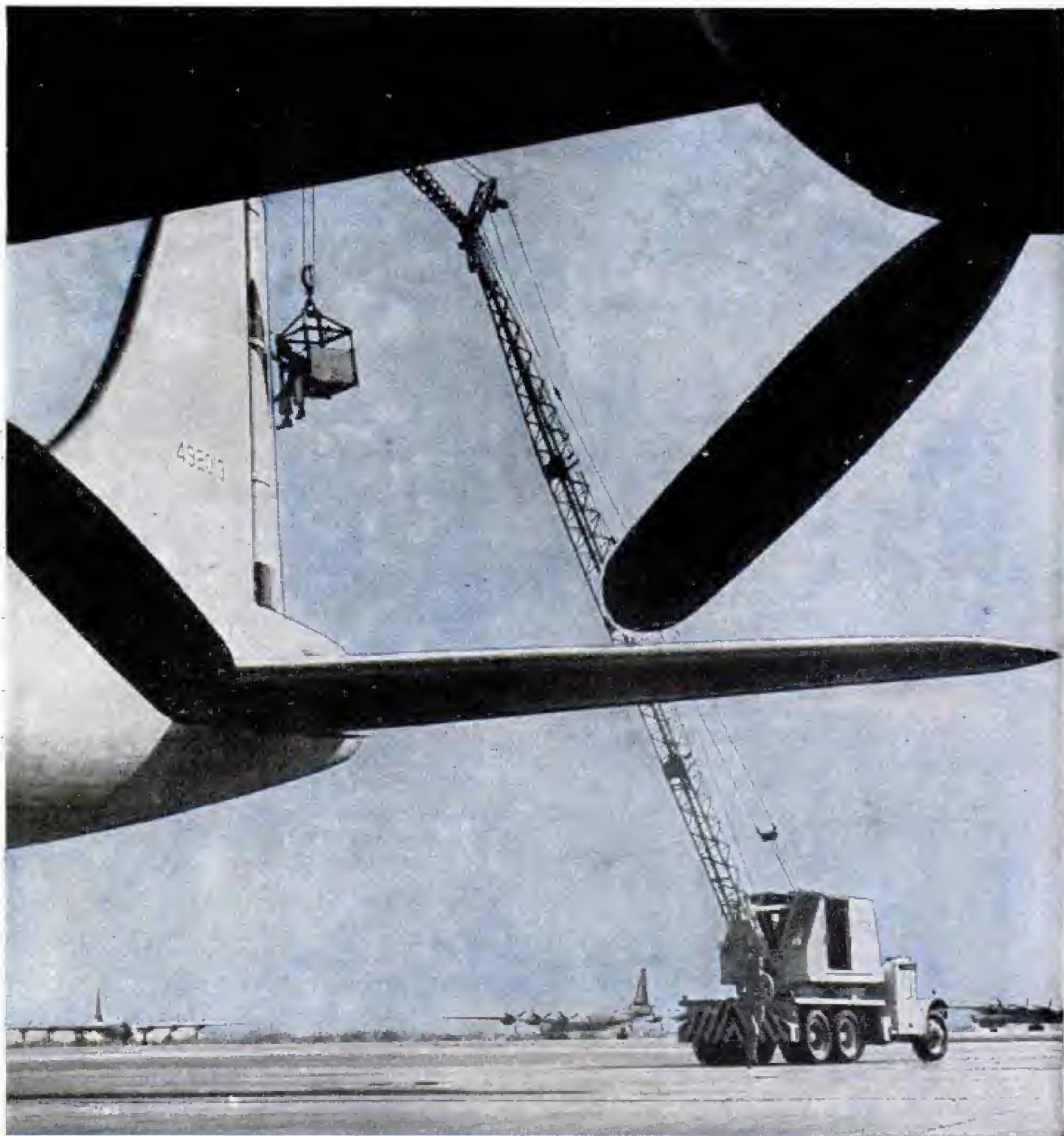
The rudder fin is so high that, to open

plates for inspection of control cables, our ground crews have resorted to ingenious stunts. I've seen them hoist a man to the top of a 50-foot crane, using an empty oil drum as a crow's-nest from which to work on rudder hinges.

From nose to tail-gun turret, the B-36 measures better than 50 yards, much of this distance being devoted to four bomb bays.

Total weight of the empty plane approximates 80 tons, and it can carry upwards of 60 tons of fuel plus bombs, ammunition and crew members.

It is advertised to carry this load nearly half around the world.



U. S. Air Force photo

Airman in a makeshift crow's-nest is hoisted toward the sky to inspect the towering 46-foot 7-inch tail

The big birds are powered with six 3500-horsepower engines with a total of 21,000 horsepower, 2½ times that of a Superfort B-29. These engines are mounted aft of the wing to push the behemoth instead of being mounted in the usual pulling position. This mounting gives them a peculiar and easily identifiable sound.

The propellers, having a diameter nearly that of the screws of the Queen Mary, all may be reversed in pitch. When the blades are twisted from their normal angle they hold back the big craft, a feature which allows landing in a shorter space than many airliners.

Literally, the landing wheels are "trucks." Four oversize wheels combine to make up each of the main gear. With two more wheels in the nose gear, the ship stands on 10 wheels, each bearing less weight than a wheel on a B-29.

First of the B-36 types to be equipped with supplementary jet pods will be reconnaissance models. This hints at the importance of reconnaissance in the estimate of Lt. Gen. Curtis E. Lemay's Strategic Air Command — America's "cocked fist."

These jets will furnish additional power for extremely heavy loads and help lone planes to return pursuit more easily. Many reconnaissance missions will be single-ship sorties.

The problems involved in planning, preparing and executing an extreme-range mission keep the flight crew busy for many hours before and after the flight itself.

In the air, efficiency requires the staggering of duty time, sleeping time and meal periods, in addition to the teamwork vital to top-rate accomplishment for the many hours of flying. Some of the unexpected situations we met were indeed amusing.

Even before take-off, we got a bewildered feeling as we realized we would cover a route equivalent to flying nonstop from Boston to Tokyo, and that when we landed, it would be right back at our starting point.

As radar specialist, I was required to help plan the route at a conference beginning at nine o'clock in the morning. The rest of the day would be used in preparation for the flight which would



U. S. Air Force photos

Crewman lies on dolly and pulls himself through 80-foot tunnel connecting fore and aft compartments. Below, aircraft commander and pilot take time out for cake and coffee during flight





Crewman squeezes through air intake to work on engine while plane is on ground. In the air, the crewmen can crawl along narrow catwalks in wings to inspect any of the six engines



With an auto-type wheel, commander steers plane along runway. Below, scanner watches flaps and landing gear for the pilot

U. S. Air Force photos



begin at six o'clock that evening.

Every step had to be planned: turning points; altitudes on various camera and radar photographic projects; weather conditions to be met or avoided; timing of our arrival at other sites with advantageous sun angles.

The flight engineers, intelligence officers, navigation officers and operations specialists all collaborated in the plans and the general and specialized briefings which followed later in the day.

After early supper, the crew reconvened at the plane for crew inspection under the wing of the big bird. Each man was checked for oxygen mask, warm clothing in the event of heat failure, parachute, one-man life raft, "Mae West" life preserver and technical equipment.

Each laid out his equipment for inspection by the aircraft commander who was also chief pilot. Besides myself there were pilots, navigators, flight engineers, gunners, scanners, photographers, weather observers and electronic experts. Almost every man was qualified for more than one duty.

Loading our gear in the B-36 was a job in itself. Each of us carried some 50 pounds in bulky equipment. Besides, there were half a dozen huge Thermos jugs of water and coffee, about four boxed lunches per man and cases of milk and soup.

Once aboard, first of the standard procedures was to "check in" with the pilot on each of the two interphone systems, reporting position, emergency oxygen supply and readiness for starting engines.

The double interphone system on the B-36 is an innovation, designed to eliminate confusion and interruption of important reports. Gunners can collaborate on one system while the bombing team uses the other without mutual interference at critical moments.

Next thing to be heard on the "hook up" was the voice of the ground crew chief talking with the pilot and flight engineer. The engines are so far back, and behind the wind as well, that the crew chief on the ground outside acts as eyes for the men in the cockpit.

Engines are started with current

(Continued to page 254)

Dreaded Quicksand Debunked in Tests

That old bugaboo, quicksand, isn't nearly as dangerous as most people think, according to Prof. J. O. Osterberg of Northwestern University, who has been making measured tests of the stuff. Quicksand is mostly water with sand floating in it. Because it has a higher specific gravity than water, a person can float in it with greater ease than in water. What makes it seem dangerous, Osterberg says, is that it is thick, hampering the movement of arms or legs. Osterberg proves his point with the aid of Willie, a toy rabbit which he has weighted to equal the specific gravity of a human being. Only the tips of



Willie's ears stick out when he is dropped in a tube of water. In quicksand, Willie stays out from his waist up.



"Big Mo"—Sample Size

Ever hear of the flea that wanted to be an elephant? Now we have a ferryboat that tries to emulate a battleship. Not long after the "Big Mo" was pulled off her mudbank, the little ferryboat Dutchess steamed out of her slip at Beacon and headed for Newburgh, N. Y. The pride of the U. S. fleet had nothing on the Dutchess, for the ferry promptly ran aground on her own mudbank. A day later she was refloated with the aid of two tugboats, a flood tide—and, presumably, the plans for floating the battleship Missouri.

Magnet Flips Pages For Violinist

Violinists turn the pages of the musical score without missing a beat by means of magnetism. A short length of wire tipped with a small magnet is attached to the violin scroll. At the lower right-hand corner of each sheet of music a small metal tab is clipped. When the violinist swings the scroll down toward the music, the magnet attracts the metal tab, raising the sheet.





From sleek grille to long rear fenders the '51 Packard is an all-new car. This is the 200 series two-door sedan

PACKARD '51 TAKES A BOW

By Siler Freeman
Automotive Editor

PACKARD dealers are displaying the 1951 line of cars, just brought out by the company, which represents an almost complete break with all Packard traditions. The models are completely new, outside and in, including styling and a new power line-up.

Except for an adaptation of the familiar Packard radiator lines in the 1951 car and retention of the hexagonal hub caps which always distinguished the company's products, the new models have gone all the way to join the low-silhouette, wide and streamlined trend in the industry. The car has been lowered two inches and the rear seats moved forward to add 12 inches in width to the seating room in the back.

Also showing the trend in the industry is the fact that Packard has gone to the notch-back styling, which adds trunk space.

Packard has also joined the high-compression engine advocates. It has two new engines, one of 288-cubic-inch displace-

ment and the other 327 cubic inch. It develops what it announces is the highest compression in the industry, 7.8 to 1, by using a cast-iron high-compression head.

The high-compression head is not new to the industry. Pontiac has offered one for some time and, with the emphasis on higher compression and better fuels, it is now starting to sell a lot of cars to customers. Pontiac would sell many more if it would emphasize this feature, but for some reason or other the division has been loath to talk about the head, which gives 7.5 to 1 without changing the engine. Hudson some time ago also demonstrated how it could step up its regular engine to almost 9 to 1 with an aluminum head, using aviation-type gasoline.

Packard's new Thunderbolt engine with its high-compression ratio is teamed with the Ultramatic Drive. On one model the combination is standard; on the rest it is optional.

The smaller engine is rated at 135 horsepower regularly and develops 7 to 1 compression ratio. With the Ultramatic, the

engine is equipped with the high-compression head and develops 7.5 to 1.

The big engine is 150 horsepower but teamed with the new head and Ultramatic, it goes up to 155 and 7.8 to 1 compression ratio. The engine powering the 400 has a nine-bearing crankshaft for quiet operation. Premium fuel is recommended.

Both engines have new mounts with re-located three-point suspension to minimize vibration. The new power plants are equipped with hydraulic vibration dampers. The big engines have hydraulic valve tappets and larger spark plugs.

Ultramatic, which Packard developed, is unchanged in principle but has been improved in performance, the company states.

Other improvements announced in the 1951 models are a new frame assembly, a water pump which delivers adequate cool-

ing pressure even when the level is low, larger brakes, a clutch pedal on models not equipped with Ultramatic which requires only 16 pounds of foot pressure, asbestos-lined muffler on the custom series for quietness, wider rear springs and a gas tank that holds 20 gallons.

As a "first" Packard points with pride to new shock absorbers. They are direct action with special valving which adjusts automatically for all types of road shock.

The 1951 Packard comes in three series, the 200, 300 and 400. The 200 is on a 122-inch wheelbase, while the other two are on a 127-inch wheelbase. The 300 and 400 differ principally in interior fittings and trim.

The 200 series comes in the standard and de luxe lines. This series will offer later a sports coupe, which joins the parade of so-called "hardtops." It offers the customer the

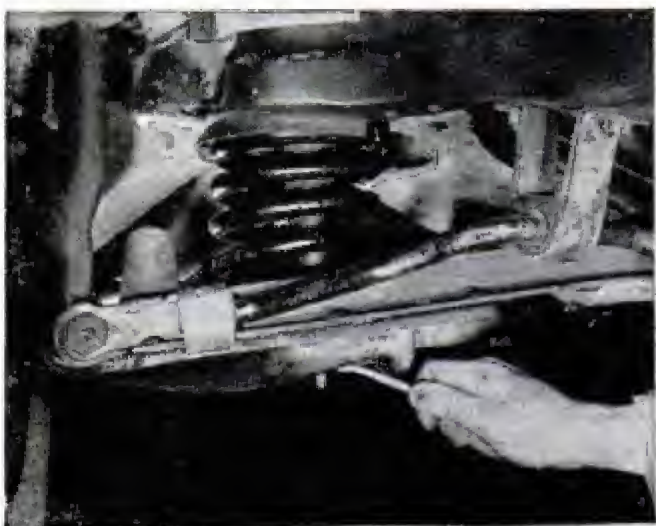


Luxuriously finished, the 300 series four-door is two inches lower than its predecessor and has a rear seat 12 inches wider. The sweep-around rear window increases visibility, and bustle back yields more trunk space.





No "Fibber's closet" is this glove compartment—it pulls out like a drawer. Below, new direct-action front shock absorbers are placed inside coil springs



choice, however, of either of the engines.

In the 200 standard line, the company has a sedan, club sedan and business coupe. The latter is a very evident price leader, designed to compete against the medium-price cars.

In the 200 de luxe line, besides the hard-top, the models include a sedan, club sedan and convertible. The 300 and 400 series will only offer sedans.

Outwardly, the new Packard is distinguished by its low silhouette and sweeping fender lines; the fenders are higher than the bonnet, with the hood lowered by five inches. The over-all height of the car is 62 inches but the road clearance has been kept the same. The over-all length has been increased five inches.

The 1951 Packard has a one-piece, curved windshield and the defroster opening is clear across for better vision in winter. The rear windows are swept back and vision has been increased 96 percent.

As said before, the rear seats have been made 12 inches wider by moving the wheel housings out and relocating the seats. Front seats have been widened two inches.

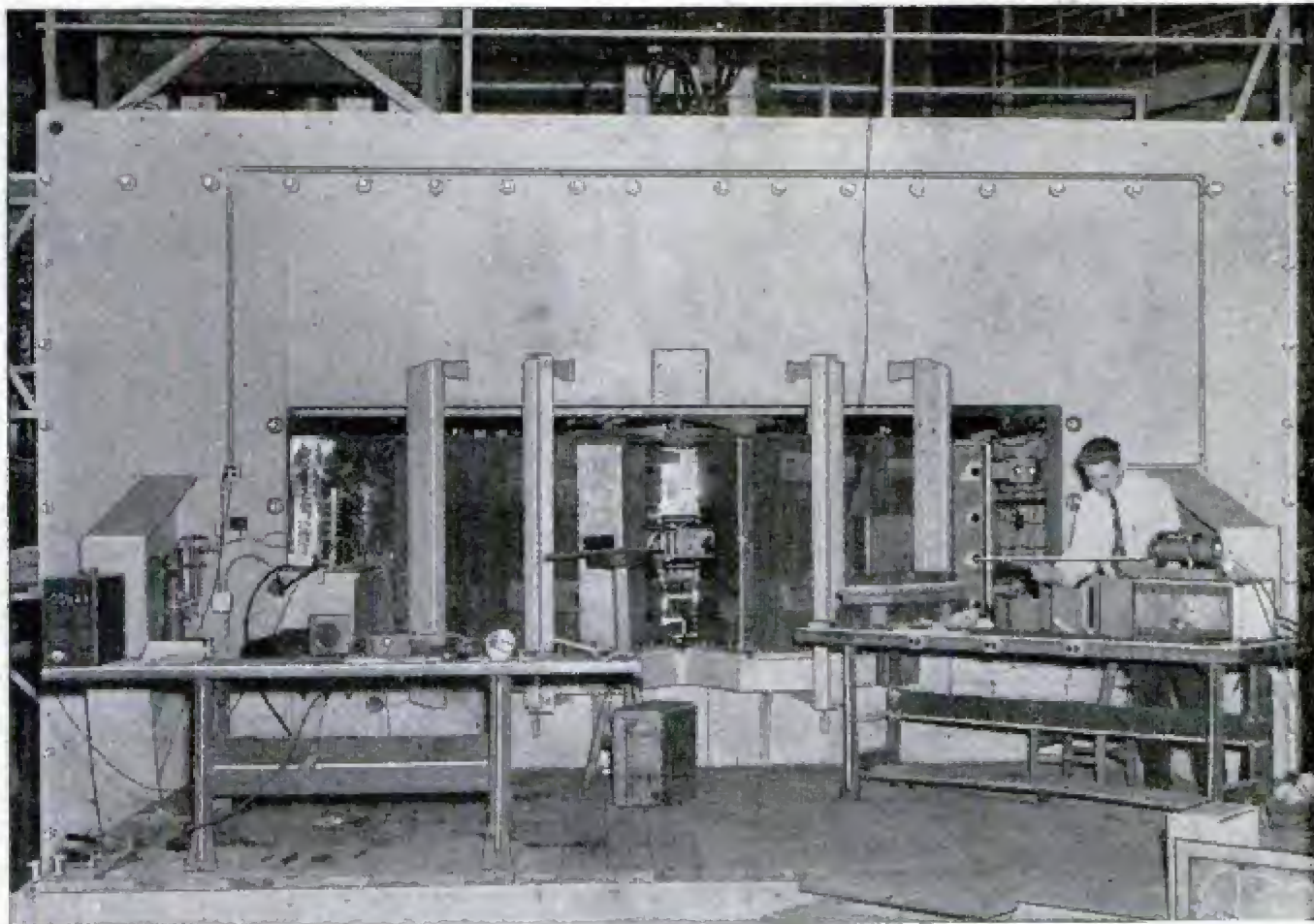
The 1951 line has a new dash instrument, with red lights flashing when oil pressure gets low or the generator fails to charge. The radio antenna is operated electrically instead of by vacuum. A rear-compartment loudspeaker is provided.

Packard has made wide use of plastics in its new models. On the 200 series, plastics are used at scuff points and door panels, and in the 400 it is used in combination with fabrics for rich effects.

The Packard "family" expects big things from its new offerings. The models have many points of interest that may appeal to auto buyers during the fall market season.

Packard 300, completely redesigned, poses with last year's model. Note lower hood, wider body, higher fenders





Rays from the 300-million-volt betatron, above, leave the center opening and are measured by instruments on table at the right of photo. Right, Prof. Kerst, inventor of the betatron, at control panel

Super Betatron

Mesons, believed to be the "something" that holds the atom together, have been produced artificially by the new 300-million-volt betatron at the University of Illinois. The machine, designed by Prof. Donald W. Kerst, inventor of the betatron, develops radiations 20 times greater than any other similar machine. This radiation is 14 billion times the concentration of energy showered upon the earth from outer space in cosmic rays, the natural source of mesons. The Illinois mesons were produced when 300-million-volt X rays smashed into the atoms of a carbon stick. The X rays, rushing at the speed of light, bombard atoms,

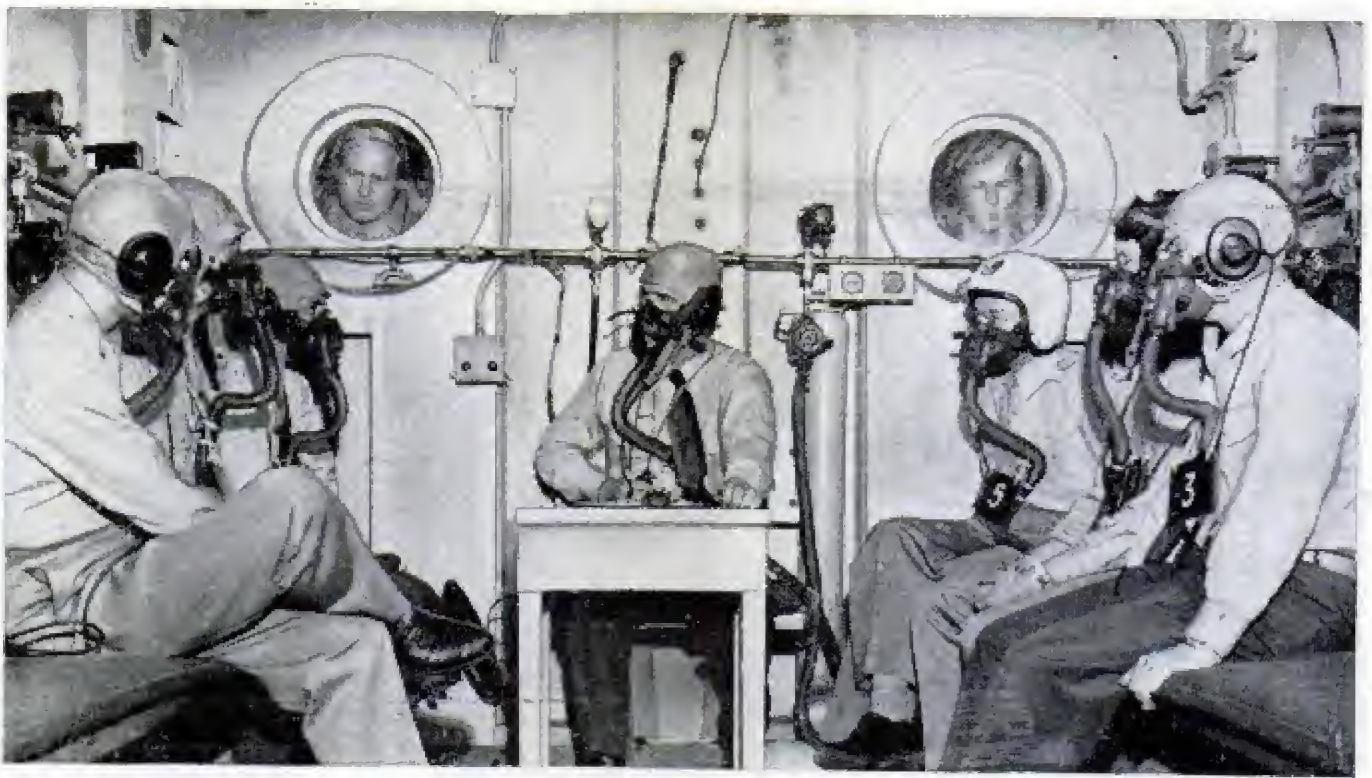


exploding them and knocking loose particles such as mesons. Research with the betatron may help reveal whether there are particles in the atom more fundamental than is now known.

More Potent Fly Killer Extracted From Weed Root

From a weed root has come another potent fly-killing insecticide. A chemical called scabrin, it is so toxic that the Department of Agriculture thinks it may supplant pyrethrum, the knockdown agent in most sprays containing DDT. Scabrin oc-

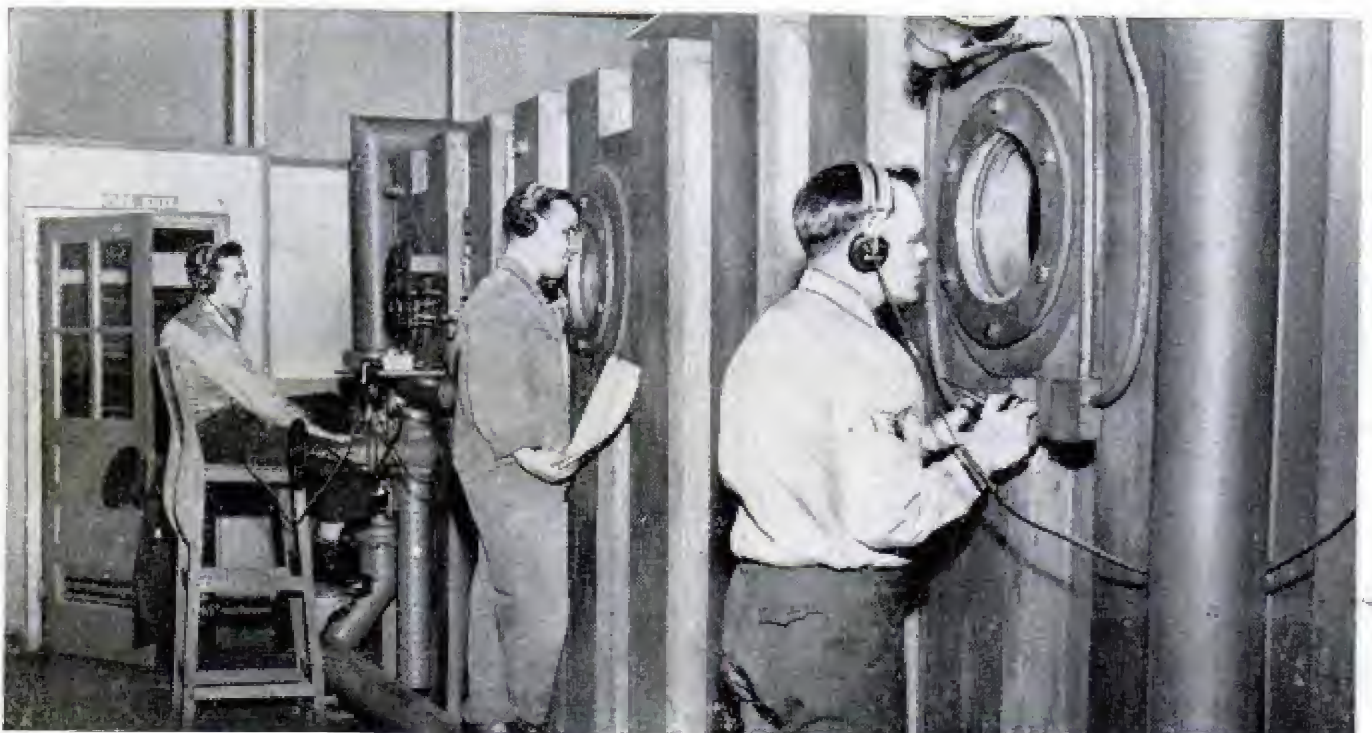
curs in the roots of oxeye, a cousin of the sunflower, and could be cultivated and harvested mechanically with greater ease than pyrethrum, which requires hand-picking. Tests are being made to determine whether it is safe for general use.



↑ While the "altitude" inside the chamber is raised, an aviation physiologist briefs pilots on what symptoms they may experience when pressure is "blown out"

← Watched and timed by the observer at left, a pilot blacks out in 45 seconds at 35,000 feet. Coordination board shows other pilots how he loses muscular control

↓ During the "flight," observers keep a wary eye on occupants of the chamber through portholes, ready to rush inside if needed. Man at left controls altitude



Explosion to High Altitude

A SQUADRON of Thunderjets stretched long white trails from their wing tips as they roared over Langley Field at 35,000 feet recently. Suddenly one of the planes wobbled. The pilot, semiconscious from lack of oxygen, accidentally released the emergency catch on his canopy. With a resounding pop, the Plexiglas hood flew into space. Jolted by the explosion and exposure to thin, icy air five miles above the earth, the frightened pilot peeled off, dove for the earth and landed safely but badly shaken from his experience.

In peacetime, such action is commendable, but in war, planes can't always desert the mission whenever cabins are shattered by gunfire, or canopies pop off. To familiarize pilots with sudden exposure to high altitude, the Air Force has built an "explosive decompression chamber" at the Mitchell Air Force Base on Long Island. Under the direction of Capt. William T. Larkin and six technicians, groups of 16 pilots at a time are put through the jolt of exposure to a sudden five-mile height.

In a 19-ton chamber of ¼-inch steel, 20 feet long, nine feet wide and seven feet high, the helmeted and masked pilots sit in a simulated altitude of 10,000 feet, apprehensively eyeing the aeromedical technician as he prepares to catapult them to the rigors of a quick 22,000 to 25,000 feet. There is no sound except the hiss of air being pumped out of the adjacent antechamber—creating a semivacuum there. In the steel wall separating the two chambers is a six-inch porthole, sealed with three layers of celluloid film. The technician watches a gauge telling him the air pressure in the antechamber is gradually approaching the necessary level. At the crucial moment, he reaches for a poker, jabs and ruptures the film seal over that porthole. With a roar, air gushes from the personnel chamber into the semivacuum in the outer room. Air, sucked from the lungs and stomachs of the men, burbles around the edges of their masks as pressure plummets. Their lungs feel as though they've been bathed in ice water. Fog forms momentarily in the thin air, then vanishes. In less than a second it's all over.

"Explosive decompression is an unknown quantity to most flyers," explains Sgt. Glenn H. Crittenden, Mitchell's aeromedical technician. "They've heard of it but they don't know what to expect. The constant worry affects their efficiency. So we show them, here in the chamber, that it won't hurt them."

The chamber is made of 12-inch-wide

channel-iron strips electrically welded with a two-inch lap at the web. Set in the walls are eight observation ports. Trained observers watch through these to notice reactions. Besides explosive decompression, various altitudes can be simulated in the big chamber by removing air with a vacuum pump powered by a 15-horsepower electric motor. An oil-seal pump is used instead of a water-seal pump, because the water seal will leak air at 60,000 feet. The oil-seal pump permits chamber altitudes of 100,000 feet, although personnel are not taken over 35,000 feet.

Hypoxia results from lack of enough air pressure to force sufficient oxygen into the blood stream. It's usually evident about 10,000 feet, and it's insidious. Most pilots are too busy flying to notice the symptoms—a slight headache or dizziness, nausea or panting. Their lips or finger tips turn blue, but are too well covered to be noticed. When they've passed out, it's too late.

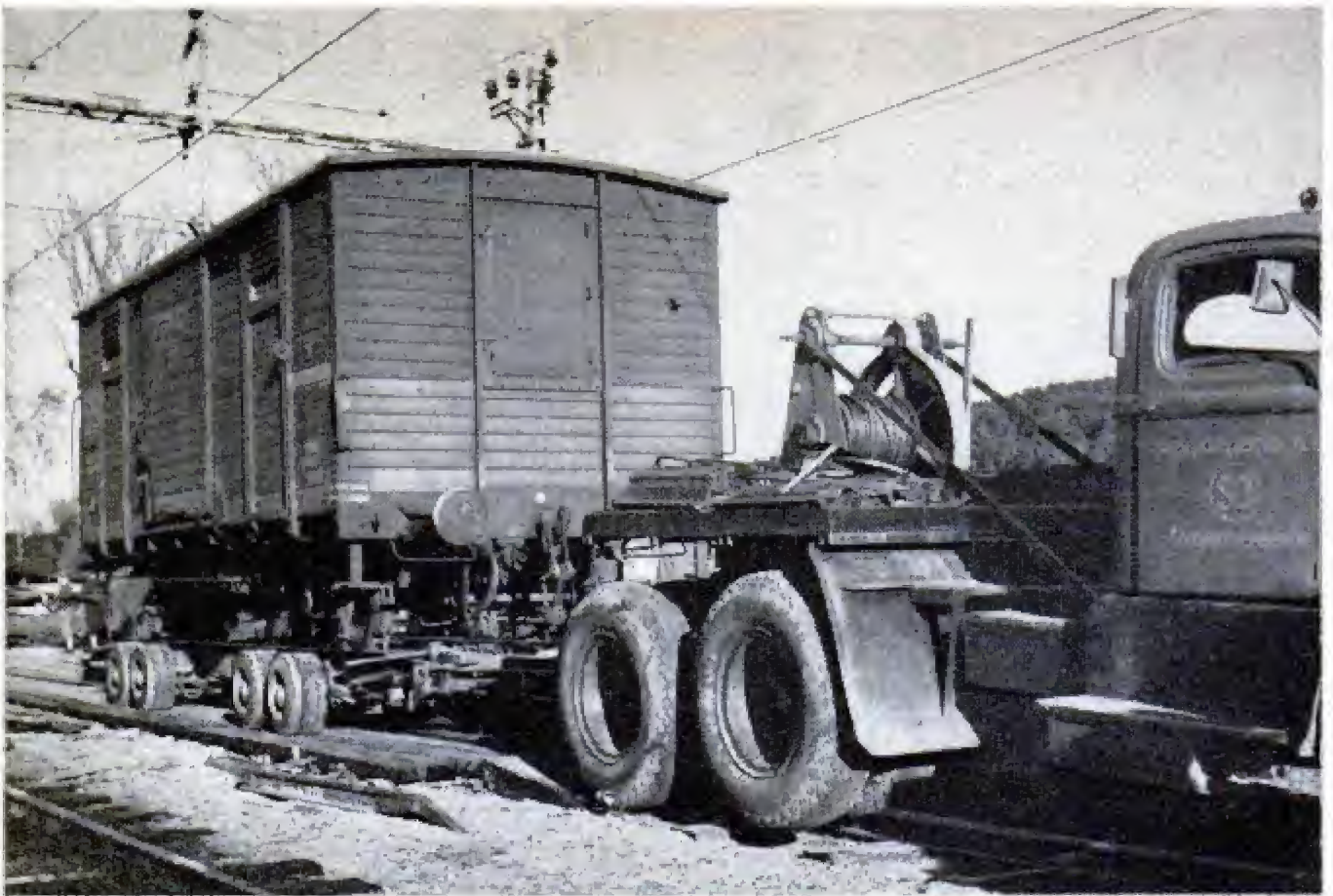
To acquaint pilots with their hypoxia symptoms is part of Captain Larkin's job. Sixteen flyers at a time are "flown" to 18,000 feet where the effect of hypoxia on vision is demonstrated. Then, after everyone has gone on oxygen, the altitude is raised to 25,000 feet where a volunteer removes his mask. He usually stays conscious about three minutes.

At 35,000 feet another volunteer takes off his mask. At this altitude he rarely stays conscious more than one minute.

Hypoxia victims have no memory of unconsciousness, and when revived they'll continue to do whatever they were doing when they passed out. To prove to volunteers that they were unconscious they are asked to keep writing their name until the instructor tells them to stop. Before they've stopped hypoxia develops and they are no longer writing, just making short strokes or jabbing the pencil lightly at the paper.

The pencil is then turned around and the victim given oxygen. Upon reviving he continues to write his name with the pencil upside down. He's always surprised to discover the eraser on the paper instead of the lead. One first lieutenant became hypoxic at 25,000 feet while writing his name, rank and serial number. He started promoting himself. First he was a first lieutenant, then captain, then major and then chief of staff of the Air Force.

But whatever his rank might be when flying at 35,000 feet, the decompression chamber at Mitchell Field has made a better pilot of him by acquainting him with high-altitude problems and how to handle them.

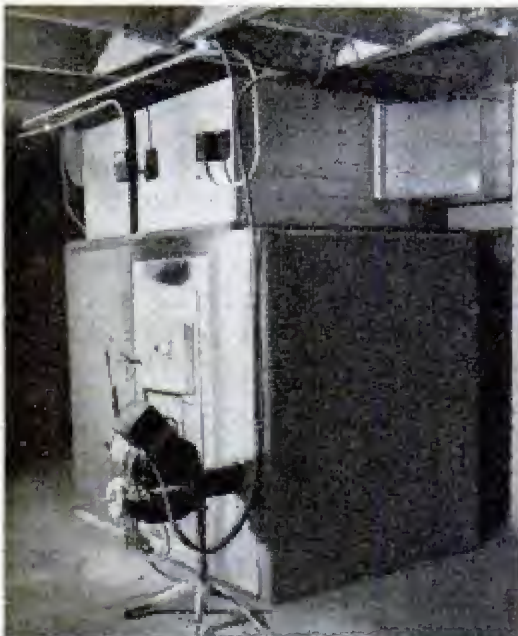


American-Swedish News Exchange photo

Freight Car Hits the Road

Freight cars leave the tracks and are hauled right to your door by means of a special trailer developed by the Swedish

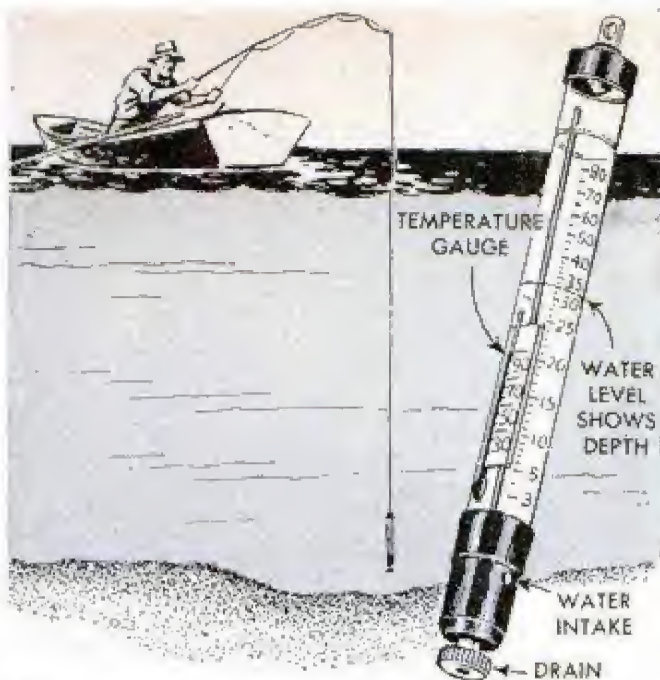
State Railways. The trailer has 16 wheels to distribute the load evenly over the pavement. A winch on the tractor pulls the freight car onto the low, flat trailer bed for over-the-highway travel.



Oil-and-Coal Furnace

Oil and solid fuel can be burned at the same time or at different times when a special combustion unit is added to a conventional coal furnace. If the furnace is hand-fired at a temperature above the setting on the thermostat, the oil burner does not operate. When the solid fuel burns down,

the oil burner comes on to boost the heat and aid in burning any solid fuels which remain. An opening from the oil combustion chamber enters the solid-fuel chamber on a level with the grates to utilize the greatest heating capacity of the furnace. The unit can be installed in coal furnaces which have all-steel bodies and supply gravity or forced-air heat.



Plug Records Water Depth

Cast like a plug, a new fishing instrument tells the angler the temperature and depth of the water. The transparent-plastic cylinder is scaled from zero to 70 feet and contains a thermometer. When the fisherman casts the instrument, it settles through the water until it rests on the bottom. Water pressure at that depth forces a sample of water to a corresponding height inside the instrument, where it is trapped until the fisherman releases it. The temperature of this water is read on the thermometer. By casting the instrument several times, the fisherman can find holes or underwater springs where fish are likely to be found during certain seasons.



Protector for Truck-Tire Fixer

Truck drivers and repairmen are protected from serious accidents while inflating tires by a tool which holds the lock ring in place in the event of a blowout. One arm of the tool locks under the edge of the rim. Another arm then is slipped across the front of the tire, preventing the lock ring from flying off. If the lock ring is distorted or out of place after the tire is inflated, the tool cannot be removed, thereby warning the truck driver that the tire has been mounted incorrectly.



Foot-Operated Grass Catcher

Cut grass is flipped to the back of a new grass catcher for lawn mowers when the operator steps on a pedal. Grass which sometimes tends to gather near the front of



a catcher is moved to the rear by a hinged plate. The plate swings up when the foot bar is pressed down, shoving the grass deep into the catcher. The attachment is made in two sizes to fit all hand mowers and some power mowers.



One small battery and a capacitor, shown at right, operate all the flash equipment in the left-hand photo

Battery-Capacitor Flash Gun

It takes only one tiny battery, small enough to fit in your watch pocket, to fire up to seven flash guns using as much as 100 feet of wire when the flash system is capacitor operated. The capacitor is charged automatically just before each exposure and it releases 15 times the voltage of regu-

lar flash-gun batteries. In normal operation, the battery, a 22½-volt B-battery, has a life of about two years! Current flows from the battery to the capacitor only when a flash bulb is in the socket. As soon as the bulb is fired, the circuit is broken. It takes only a second or two to recharge the capacitor. Solenoids work briskly even in zero weather with the system.

Midget Autopilot Light Enough for Fighters

More compact and less than half the weight of previous models, a new automatic pilot is small enough to be produced for fighter planes. The complete unit weighs only 52 pounds. Its working parts are

sealed in hydrogen to provide better heat transfer from the gyro to the surrounding air. Controls are simplified to include a switch, three buttons and a release button that is usually mounted on the stick.



Lightweight Waders Worn Inside Shoes

For fishermen there is a new lightweight wading outfit with all the seams welded electronically to make it completely waterproof. The Vinylite material won't mildew and resists acids, oils, grease and food stains. It is a stocking-foot wader and is worn inside tennis or gym shoes, or boots.

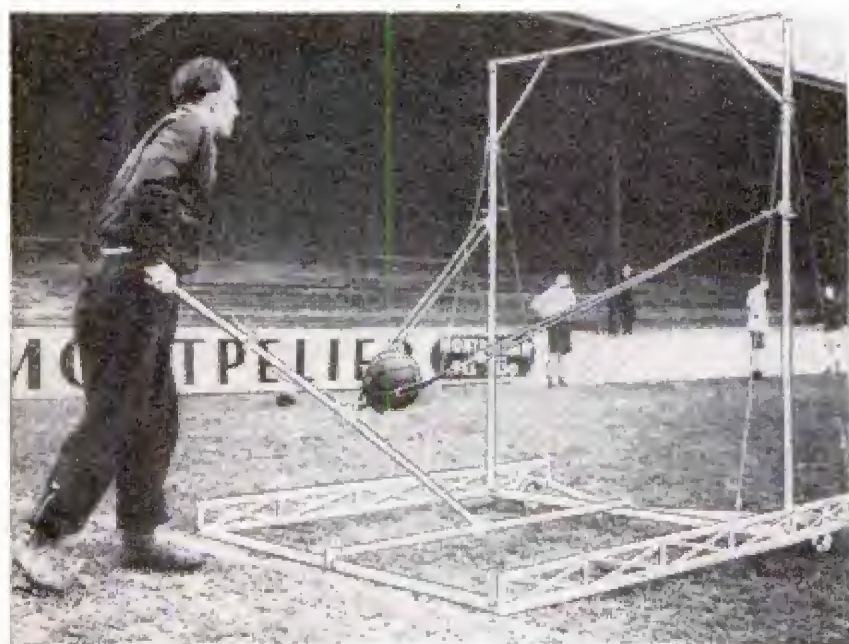
Popular Mechanics provides two sources of further information concerning the articles published in each issue: the WHERE-TO-BUY-IT INDEX, starting on page 14, and the WHERE-TO-FIND-IT LIST, which may be obtained without charge by writing Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Illinois



Practice "Guard" Simulates Game Conditions

Even the cleverest basketball and football players cannot escape a self-imposed practice "guard." It is a simulated hand supported by a flexible arm attached to a

belt around the user's waist. In basketball the upraised hand hinders a player shooting, and in football it plays the part of a lineman attempting to block a pass.



Robot Booter Tests Soccer Goalies

Soccer goalkeepers get precision practice against their defensive weaknesses with a new automatic ball kicker. It can propel

balls at the rate of one every 10 seconds and can be adjusted to boot them from different angles and at varying heights.

Newest and Heaviest Element Is Californium

Scientists at the University of California have created another new element, this one being element 98, the heaviest atom ever known. Named after the university and its state, the element is called californium and is six steps up the periodic table from uranium, the most massive element in nature. Element 98 is actually a synthetic unit of

matter, which does not exist in nature and has never before been observed on earth. It is so intensely radioactive that it has a half life of only 45 minutes. Produced by bombarding curium (element 96) with 35-million electron-volt alpha particles fired from a 60-inch cyclotron, the new element has no practical value in atomic energy.

Cars without crankshafts, trucks and busses that climb hills at top speed—these are what the engineers see in the promised . . .

REVOLUTION OF THE FREE-PISTON ENGINE

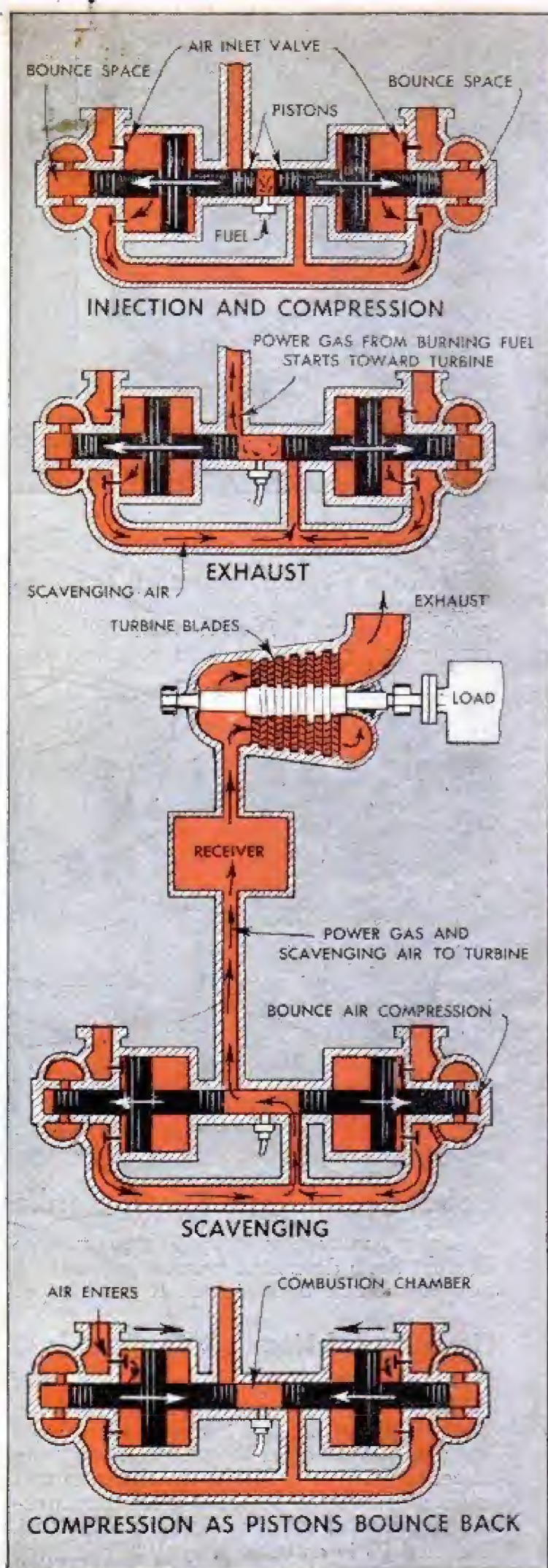
By John D. Ratcliff

WRAPS are about to be removed from a new engine which looks like an inventive milestone. The engine promises busses and trucks which will climb hills at top speeds—instead of creeping up them to present prime traffic hazards. It offers a more economical source of power for long-range planes. One railroad, the Pennsylvania, sees it as a step beyond the diesel in locomotives. In time, it may even find its way into automobiles, giving 50 to 60 miles on a gallon of low-cost kerosene!

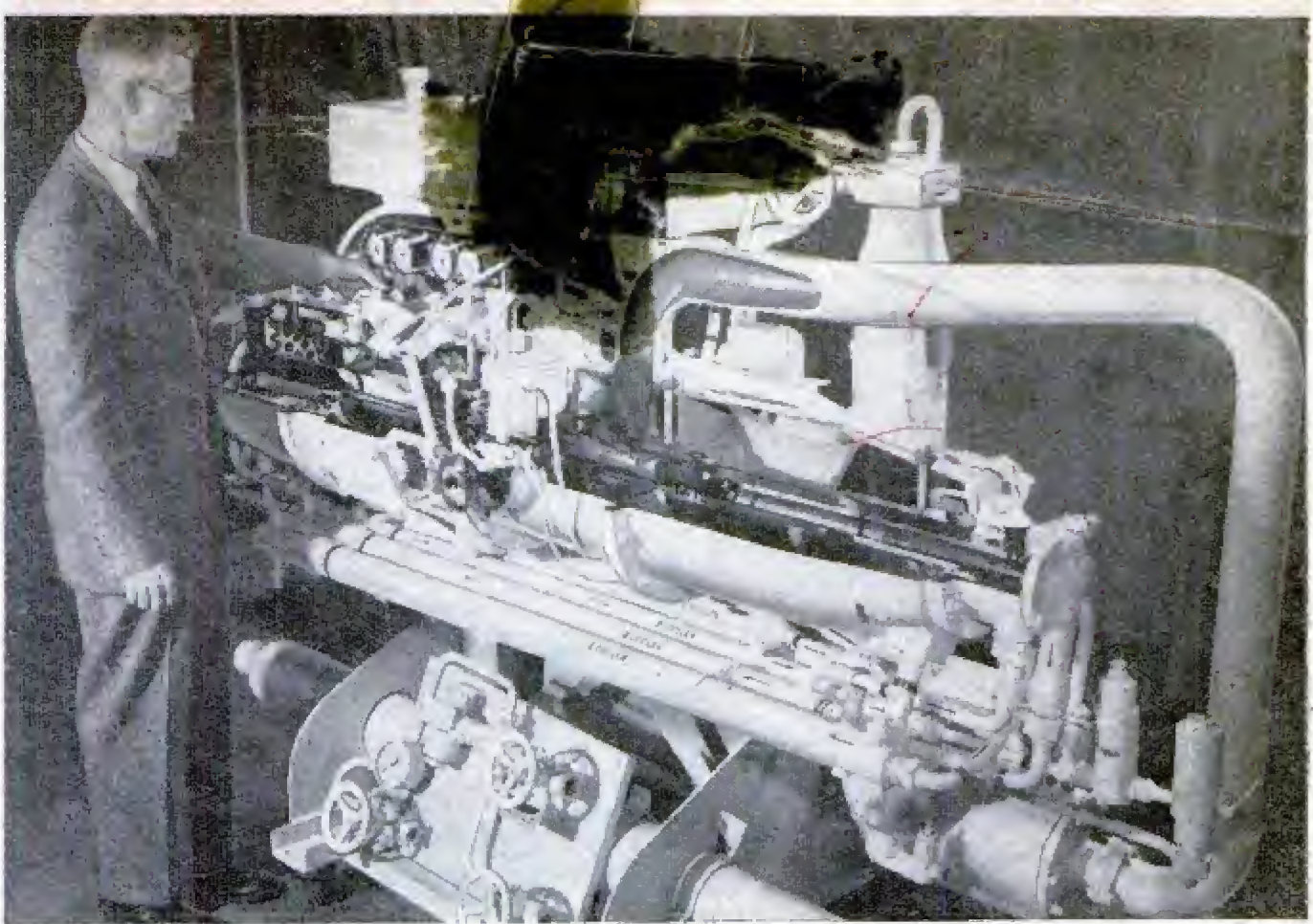
These are the things promised by the free-piston engine, a radical new power concept. As the name implies, pistons are not connected to anything. In your present auto engine there are masses of moving metal—connecting rods, crankshaft, fly-wheel. The new engine eliminates these parts. Two pistons slide freely in a horizontal cylinder. As they come together at the center they compress air so that the fuel injected will burn. In this respect the engine is like a diesel, requiring no spark plugs. As the free pistons fly apart, they compress air at the other end of their stroke. Air compressed in the "bounce chamber" acts as a springy cushion, driving the pistons back to the center again. Flying back and forth, the pistons do useful work all the time, generating hot gases in the center of the cylinder, compressing air at the ends. These gases are drawn off, run through a conventional gas turbine where they give up their power.

Thus, the engine is a kind of hybrid, a cross between a diesel and a gas turbine—combining the best features of both. It eliminates most of the diesel's moving parts and does away with the gas turbine's

Panel at right shows, from top to bottom, one cycle of a free-piston engine. Drawings have been simplified for clarity and only the major parts are shown

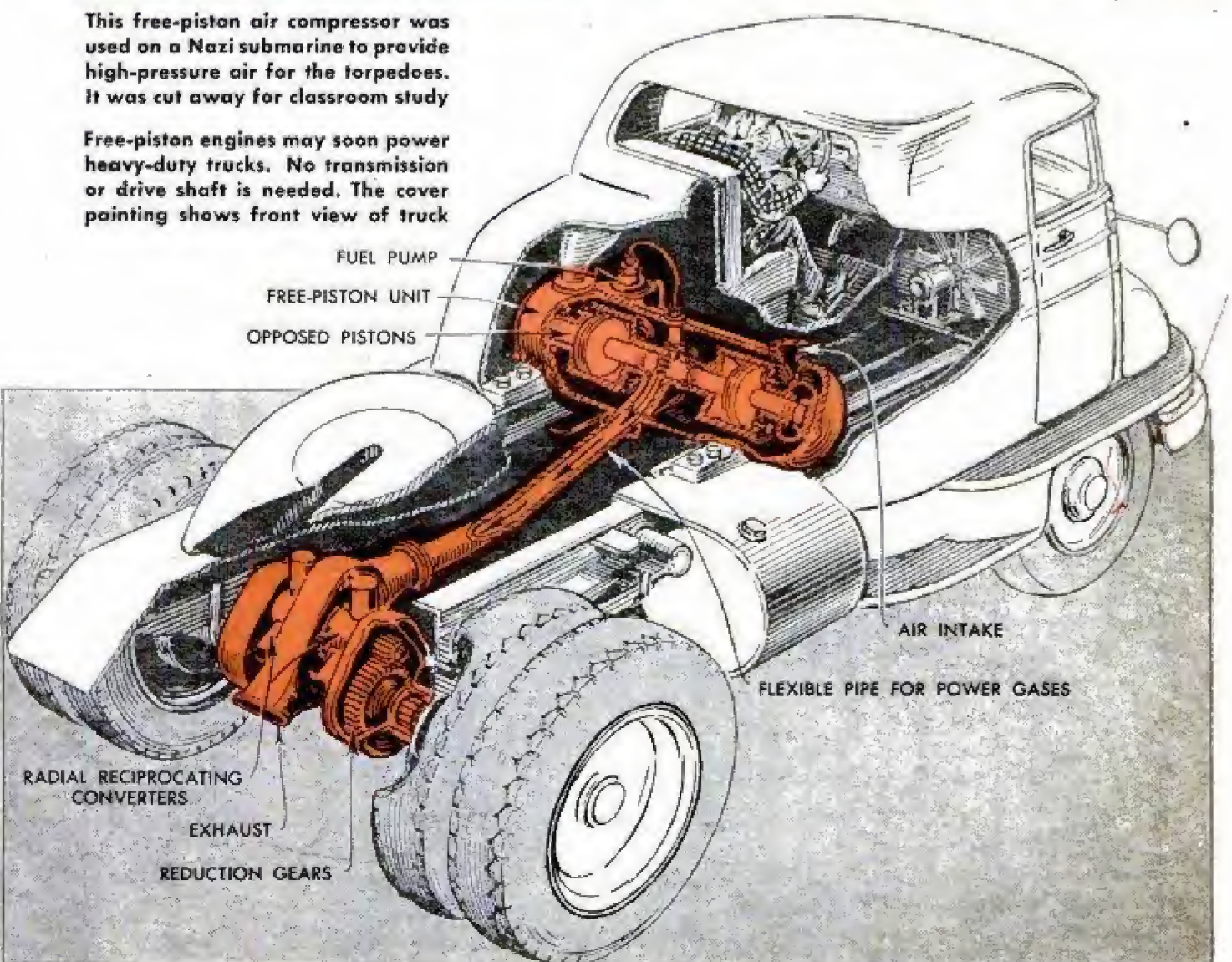


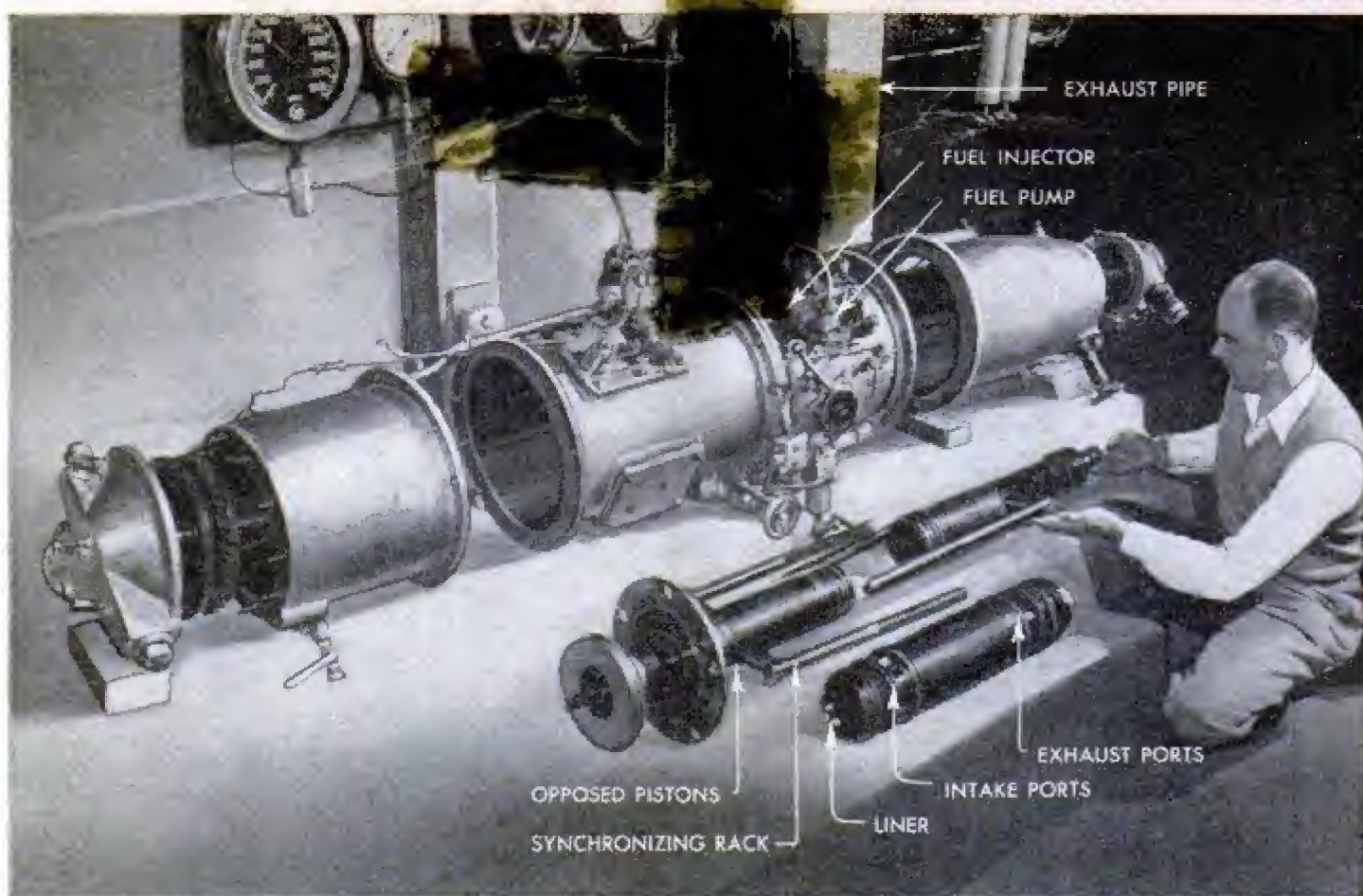
Further info - info S. B. Wagon - 229 E. 1st St. New Rochelle, N. Y.



This free-piston air compressor was used on a Nazi submarine to provide high-pressure air for the torpedoes. It was cut away for classroom study

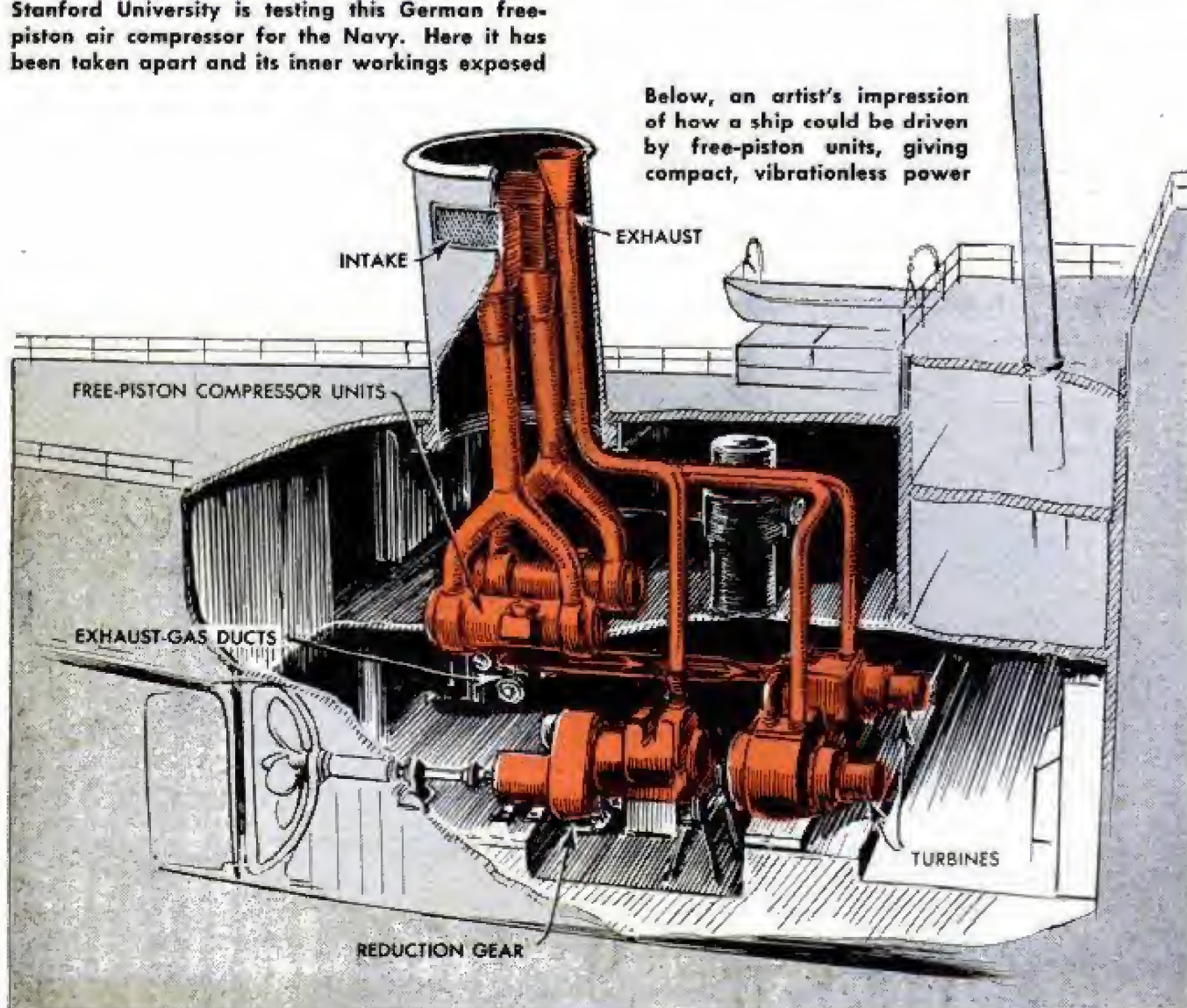
Free-piston engines may soon power heavy-duty trucks. No transmission or drive shaft is needed. The cover painting shows front view of truck

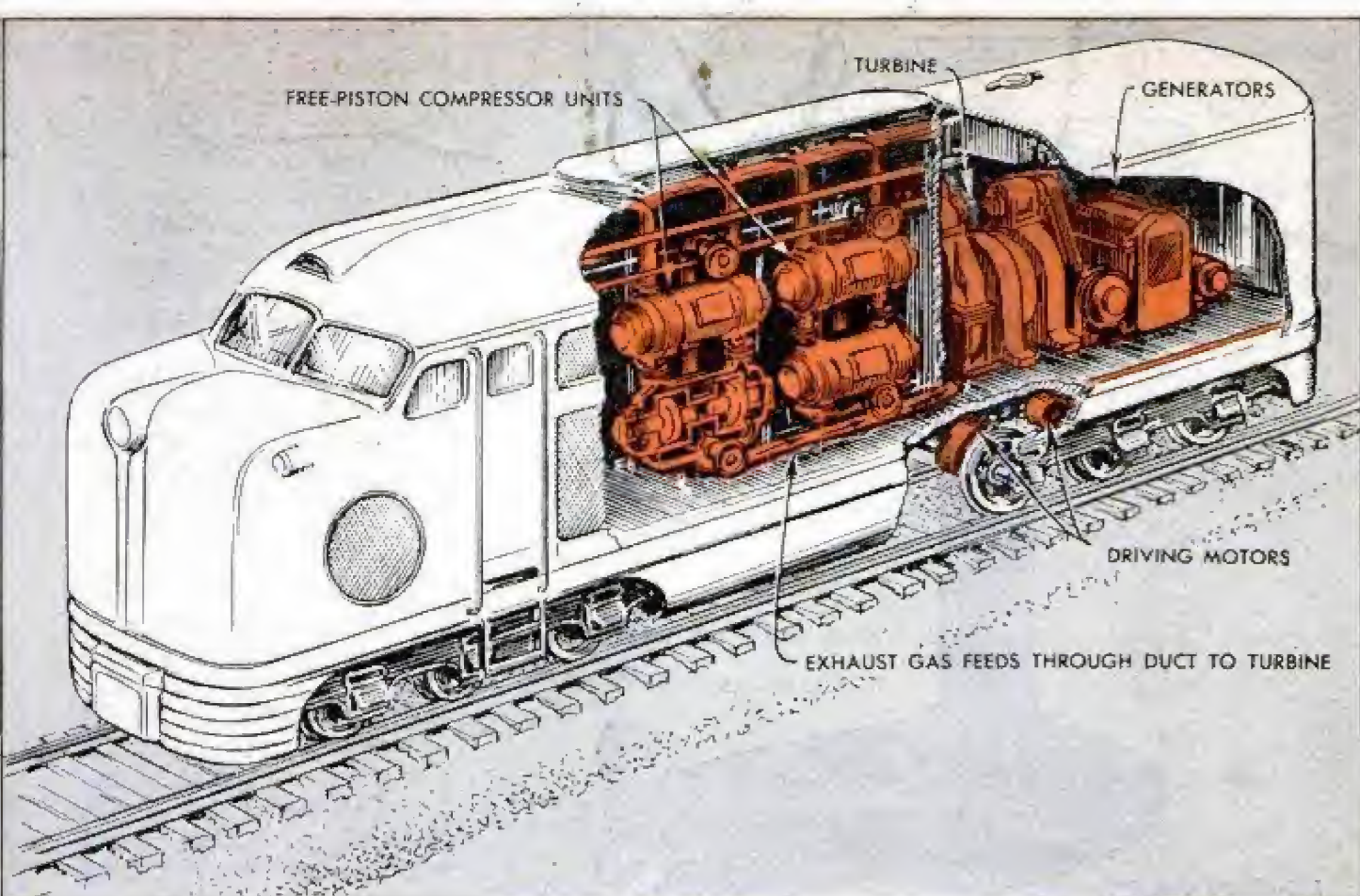




Stanford University is testing this German free-piston air compressor for the Navy. Here it has been taken apart and its inner workings exposed

Below, an artist's impression of how a ship could be driven by free-piston units, giving compact, vibrationless power





Engineer's conception of a free-piston locomotive such as is being developed for the Pennsylvania Railroad

open combustion chamber and compressor. In essence, it has but three moving parts: the two pistons and the revolving fan blades in the turbine. The engine is quiet, vibration-free, light. Aircraft engineers estimate that such an engine applied to aircraft would weigh less than a pound per horsepower. Today's best radial aircraft engines weigh about the same, but require three times as much weight in fuel.

Further, the free-piston engine is by all odds the most efficient power plant ever developed—an important point since the world stock pile of fuels is steadily dwindling. It is 40 to 45 percent efficient—which is to say that it converts this percentage of the fuel it burns into useful energy. Its nearest competitor, the orthodox type of diesel, is around 35 percent efficient.

The free-piston engine will operate on almost any fuel—natural or manufactured gas, diesel oil or other petroleum products. It can operate on the cheap oils that any diesel engine in service uses today. It can do this because it can be designed to breathe large quantities of excess air, an essential in burning low-grade fuels.

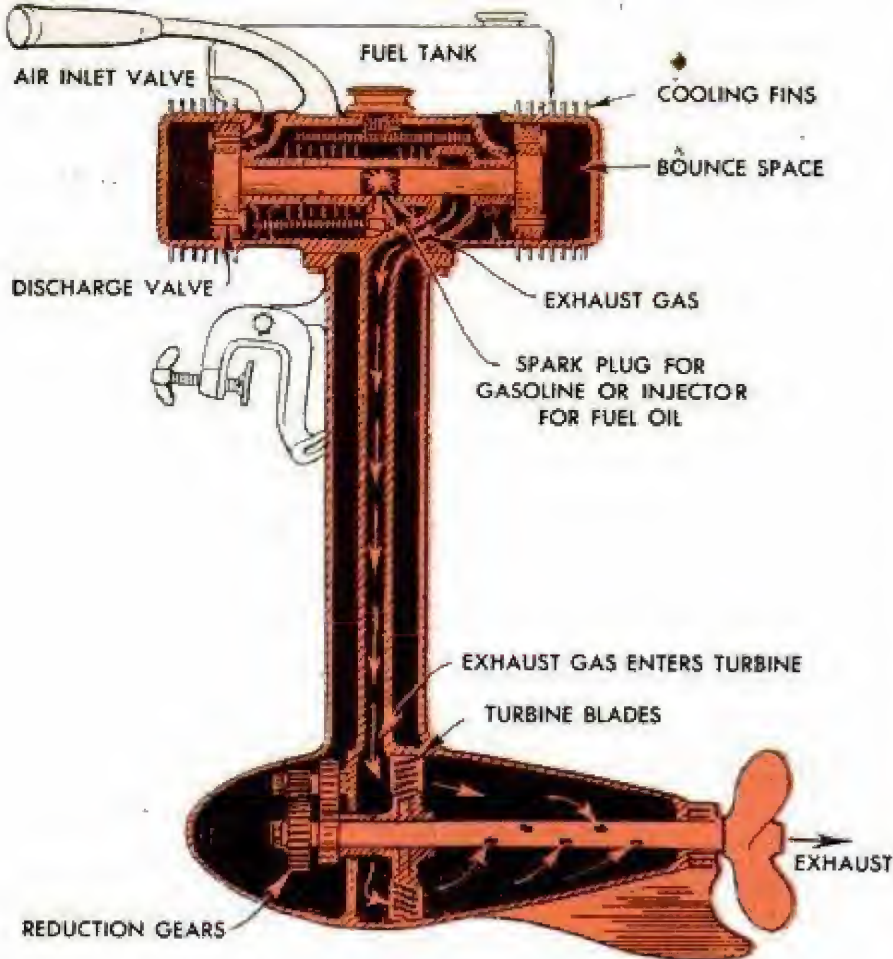
As is the case with almost any new development, the free-piston engine has gone through a long period of evolution. Nearly a century ago two Italian inventors developed a crude model in which a heavy piston was fired upward in an open-ended cylinder. It was like a cannon in which the

ball never emerged from the barrel. The rising and falling piston contained a slotted rack which turned a toothed gear, thereby giving up its power.

The Swedes got closer to the idea in the early '20s when they took exhaust gases from a diesel engine, piped them to the stern of a ship and ran them through an engine connected directly to the propeller. Clumsy and inefficient as this arrangement was it did eliminate shafting and boilers.

In the years just preceding World War II several groups were attracted by the free-piston idea. At Belfort, France, a brilliant inventive genius named Pateras Pescara conceived the idea of hooking a gas turbine onto such a machine. His company, Als-Thom, had made only a bare start on the idea when the Germans swept over Belfort and all work stopped. Immediately after the war ended, the S. I. G. M. A. works, an affiliate of Als-Thom, started again. It has built several thousand free-piston air compressors to be used in highway construction and other applications. Meanwhile, in Winterthur, Switzerland, a group of engineers at Sulzer Brothers, Ltd., also started building free-piston gas-turbine machines.

Real work in the United States didn't get underway until the middle of the war. In 1943 the Navy captured several German submarines. On them they found compact, efficient, free-piston air compressors—used



There are endless applications for the free-piston unit. A small version could be designed to make a quiet-running 20-horsepower outboard motor

to charge the air bottles which fire torpedoes. This engine burned diesel oil, drew off air compressed on the outward stroke of the pistons. It was, in other words, an air compressor, not a new engine. But alert Navy men were quick to see possibilities.

Three of the captured compressors were shipped to the General Machinery Corporation, Hamilton, Ohio, makers of half the engines used on Liberty ships, plus a complete line of diesels and other heavy engines for ships, power plants and other uses. Would General Machinery undertake a large-scale research project, hooking a free-piston engine to a turbine, and seeing if a revolutionary new power plant couldn't be developed?

The company blocked out the task, fenced

off a corner of the plant the size of a large hotel ballroom and started lavishing some of the country's best engineering talent on the problem. This was precisely what the free-piston engine idea needed—an all-out effort to solve the basic problems involved.

The Navy has yet to announce why it is interested in free-piston engines. But it doesn't take a too active imagination to see where they might be used. They would give submarines greater range and greater fuel economy. They might provide power for such vulnerable ships as aircraft carriers—spacing power at various points in the ships instead of concentrating it in a single boiler room, which might be knocked out by torpedo attack.

Civilian applications of the free-piston engine are barely getting underway. The Lima-Hamilton Corporation, which resulted from a merger of General Machinery and Lima Locomotive, has under construction a 4000-horsepower locomotive for the Pennsylvania Railroad.

Use of the new engine in locomotives has a number of attractive features. With fewer moving parts than other engines it should cut service bills.

Its higher efficiency will slash fuel costs. Further, the engine might be adapted to run on coal derivatives, either liquid or gaseous. Many railroads, deriving a major portion of their income from hauling coal, like to patronize their customers.

Adapted for coal derivatives, the engine would work this way: Coal would be converted to gas or liquid fuel. Experimental "gas generators" are already available. In them, steam combines with burning coal to produce inflammable hydrogen and carbon monoxide. One such generator is little larger than a big barrel. Fed powdered coal and operated continuously, it would produce enough gaseous fuel to feed a 4000-horsepower free-piston engine. Such liquid-fuel generators are being developed

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Glass-Bottom Pedal Boat

From odds and ends, Fleet White of Honolulu built a glass-bottom pedal boat in which to pursue his spear-fishing hobby. A pair of surplus belly tanks, each about 3½ feet in width, is connected at the front and rear by welded pieces of sheet steel. The two occupants, sitting on what was once an automobile seat, pump pairs of bicycle pedals that turn a partially submerged paddle wheel at the rear of the craft. White cut a hole in the bottom of the deck, which clears the surface by just a few inches, and slid in a watertight glass-bottom box through which he looks in his searches for the best fishing sites. The boat is steered by a lever and will do five knots.



Movie Projector Helps Grid Coach

Movies are shown in daylight with a projection viewer that can be set up on a desk, eliminating the necessity for darkening the room and setting up a full-size screen. Designed especially for the use of football coaches, the viewer allows the coach to point to details in the picture without throwing a shadow on the screen because the image is projected from the rear. The viewer is equipped with a reversing switch which enables the coach to repeat important plays.



American-Swedish News Exchange photos

Above, left, a section of the Swedish prefab arrives by flatcar and will be loaded on this truck. Above, right, workmen lift an electric range into the building. Wiring is done during the trip. Below, left, a crane lifts the section onto its foundation. Below, right, the completed building, ready for occupancy



Swedish Prefabs Keep Workers Comfortable on the Job

Swedish workers who construct electric power plants for the government live in comfortable prefabricated houses that can be hauled into rough country and put up in a day. The houses come in three sections and are factory made, with windows, doors

and cupboards fitted and painted by mass production. The sections are shipped by rail and transferred to special trucks at the destination. When the power-plant construction is completed, the houses can be taken down quickly and moved.

Earth-and-Metal Alloys May Solve Jet-Engine Problem

Earthy substances combined with metal may provide the heat-resistant alloys needed for tomorrow's jet aircraft engines. Research by the National Advisory Committee for Aeronautics indicates the most promising is titanium carbide with 20 per-

cent cobalt, which bonds well with cemented-carbide tool compositions. It has been tested at 2400 degrees Fahrenheit. Metal alloys now used in turbine blades are close to their temperature limits and ceramics have shown a tendency to fracture.

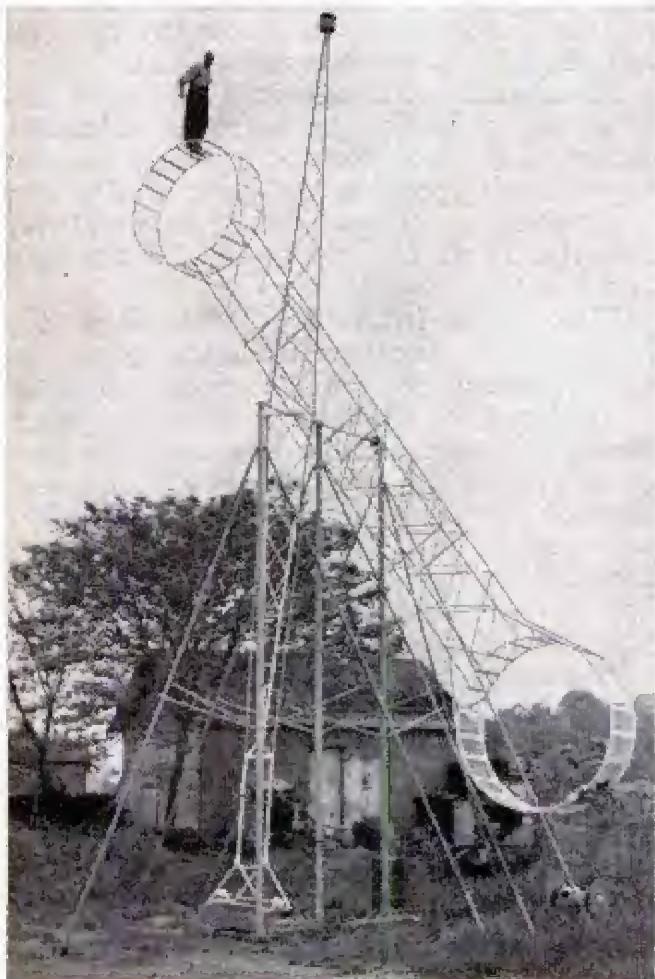
Loop-the-Looper

DURING working hours C. C. Beckett is a maintenance man at Constitution Hall in Washington, D. C. On his own time he's a daredevil who dances a jig at dizzying heights aboard a sky swing he made himself. The contraption is a huge revolving arm with a circular cage at each end. By shifting his weight, Beckett starts swinging the big arm in a circle. Then as it gyrates like a windmill he strolls around the cage or does a jig at the top of each loop. Attached to the same framework is another arm which terminates in a swing. Beckett straps his feet to the swing and, with a 100-pound weight on the other end of the arm, starts pumping the swing into a great loop. Eventually, he is hanging upside down 50 feet above the ground with his arms outstretched. So far the apparatus has cost him about \$3000 including the metal, welding and \$10 monthly rental for the site along the Marlboro Pike at Hillside, Md. Maintenance man Beckett, who once worked as a carnival juggler, hopes to land a spot in a carnival or circus with his sky-swing act.

While the big blade whirls, he strolls around the wire cage on one end, or does a jig atop the loop. His safety depends upon his ability to anticipate and counteract the pendulumlike swing of the blade



Daredevil Beckett straps his feet into his gigantic sky swing and prepares to loop the loop. Below, by shifting his weight he moves the swing in a big circle until he's standing on his head 50 feet above ground





Sifting the Story of an Ancient Race

By Norman E. Moore

Charles and Joe Thomas, amateur archaeologists, search for secrets of an ancient age in the dust found in bluff shelters of the Illinois Ozarks. They sift excavated dust in homemade screen

A MYSTERY story of the past, to which a long-dead race holds the key, is slowly being revealed bit by bit from under the dust of the sandstone-bluff shelters of the Midwest. Within a radius of 20 miles of their home, Charles and Joe Thomas, amateur archaeologists, have found more than a million pieces of pottery, bone, stone, shells and other artifacts of an ancient people who at one time lived in the caves and cliffs of the Illinois Ozarks.

The Thomas brothers operate out of the village of Cobden, Ill. For years their pastime on Sundays, after a week wielding painters' brushes, has been to roam the region searching for clues which might have some bearing on this prehistoric race—the Bluff Shelter people.

All this means laborious digging and the meticulous sifting of debris by hand. Sometimes it means using needlelike instruments to pick out specimens from dirt-filled pits. The earth beneath the bluff shelters is dry and the accumulated dust and debris is usually from five to six feet deep. From this dust are reclaimed numerous pottery fragments, war points, rough arrows and spears, awls and bone drills. Several sandstone mortars have been found with cooking stones and hammer-

stones. Under some shelters the remains of campfires have been unearthed.

Thousands of fragments of bone are found, apparently the remains of meals. Bones of the deer, fox, rabbit, coon, beaver, woodchuck, opossum and various wild fowl are commonly uncovered. Then, too, there are the shell fragments of the terrapin and mussel.

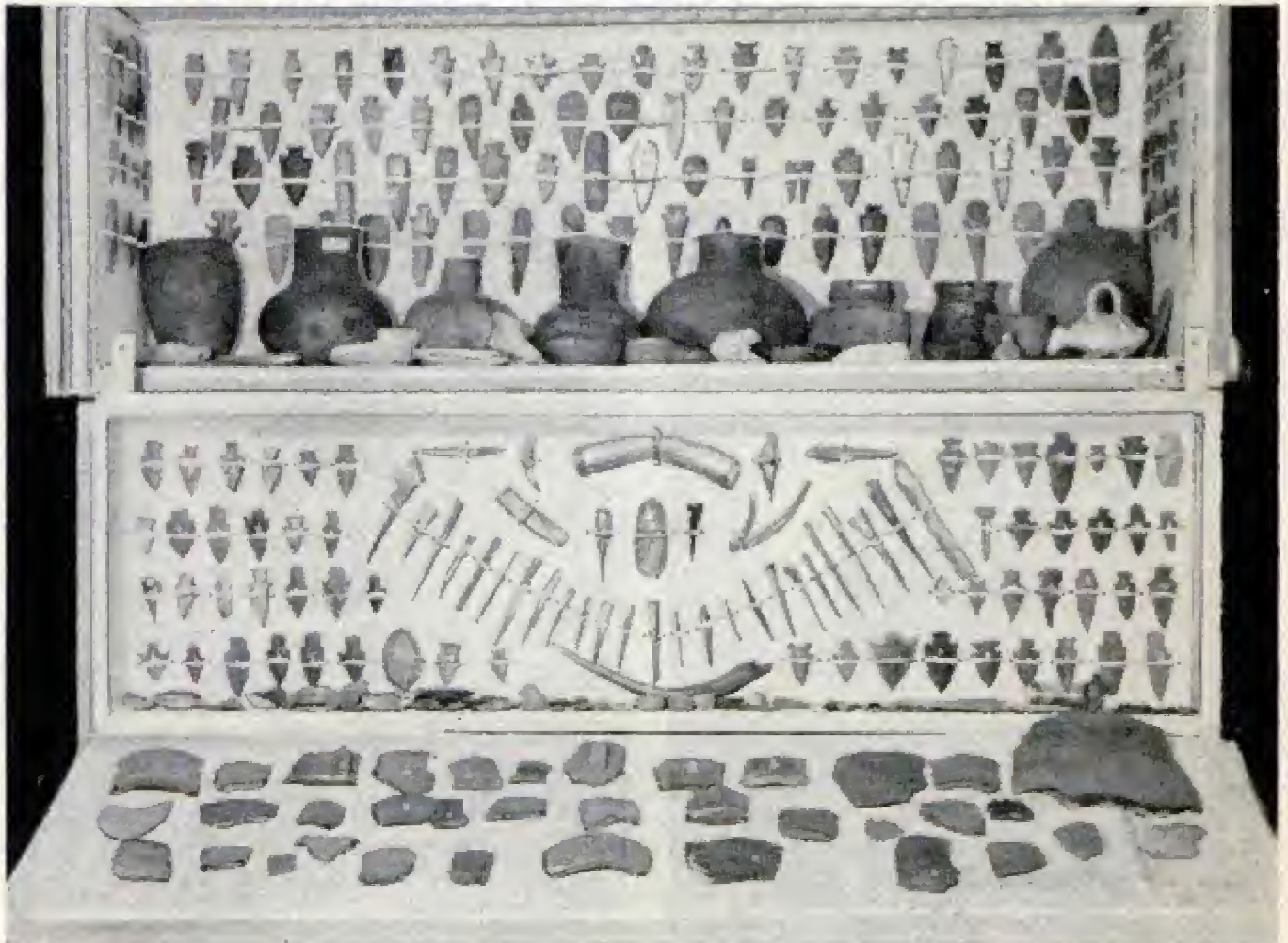
"The most interesting feature of the bluff-shelter excavations is the profusion of fragmentary and complete human bones," say the Thomases. "If these human bones were the remains of burials, someone at some time had taken great care to break them to pieces and scatter them about. Decomposition had affected them very little. How, then, can the presence of human bones be explained? To us, it has the appearance of cannibalism."

The relics they find, at least those in the lower levels of the dust, are of great antiquity. The bulk of them, it is believed, are of pre-Columbian origin while some of them may antedate the Christian Era. The Thomases are of the opinion that the sandstone-bluff shelters of the Mississippi Valley were occupied by all types of prehistoric men native to the area.

(Continued to page 244)



Fragments of bones, flint weapons and crude tools are examined by the Thomases and a friend, Joe Karstater (center). The collection includes both human and animal bones and shell fragments of turtles. Below, some of the thousands of relics gathered by the Thomases—arrowheads, pottery, ancient tools and odd broken pieces





← Wheel Converts Trike to Bike

Bicycle and tricycle are combined in a new vehicle designed for the 'tween-age child. The sidewalk runabout looks like a conventional tricycle except that it has a fourth wheel between the two rear wheels. Lowering this wheel makes the vehicle a bicycle, as the other two wheels then are raised off the ground.

Plastic Base on Photo Film

Photographic films may soon be made with synthetic-plastic emulsion instead of the gelatin emulsion generally used today. A new color film, developed by Du Pont, which uses a synthetic polymer to replace both the gelatin emulsion and the color former, may forecast a changeover for all films. Because the synthetic emulsion can be made under controlled conditions, it can be kept uniform, thus assuring constant quality. The gelatin emulsion in use today is made from the skin of calves and the quality of the gelatin varies with the diet of the animals.

Spreader-Sprinkler

Attached below the head of a new-type sprinkler, a quart-size Tenite plastic jar that can be filled with liquid fertilizer, weed killer or insecticide simplifies lawn care. Turning the jar lid regulates the amount of the solution mixed with the water and the spray covers a 60-foot circle. A hand spray at the end of six feet of hose can be substituted for the sprinkler head in killing insects and weeds.



Timer for Sprinklers

Water waste from forgotten sprinklers is done away with by an automatic device that shuts off the flow at a preset time. It couples to any standard threaded faucet before the hose is attached. The timer measures a factory preset amount of water and then turns off the flow. It is available in three cycles, running approximately $\frac{1}{2}$, 1 and $1\frac{1}{2}$ hours respectively, depending upon the water pressure.



"ON THE AIR"

By Rafe Gibbs

YOU ARE FAMILIAR with NBC, ABC and CBS, but unless you live in a college town you may never have heard of IBS. These letters, referring to the Inter-collegiate Broadcasting System, stand for a touch of Rube Goldberg, a heaping cup of youthful enthusiasm and a dash of genius.

Celebrating its tenth anniversary this year, IBS is now composed of 73 stations at universities and colleges across the nation. Working at these stations are more than 3500 students. Listening are several hundred thousand fans—rabid fans. Leaders of commercial radio are watching IBS stations like Tabby does a goldfish bowl, and are annually reaching in to scoop up more than 100 graduates.

Seeking first-hand knowledge of the inner workings of a typical collegiate radio station, we visited KUOI at the University of Idaho.

KUOI was born in 1945 when Glenn Southworth, engineering student, flicked off a radio program in the lounge of

the Student Union. "What this campus needs," he said, "is a good five-watt radio station that gives with plenty of music and a little drama that doesn't take three months to get some place."

So Southworth, who started taking the family radio apart—critically and mechanically—at the age of 10, got busy with several fellow students, and came up with a radio station. Its first equipment was a midget marvel.

The transmitter was made out of an old receiver, held together with baling wire and chewing gum. The main coil was wound around an oats box. The base was that of an old battery radio salvaged from a fraternity-house attic.

The station's present equipment, vastly improved with new parts, is still a student-assembly job. The station is also unusual in the fact that technically it never goes

Students like these, at 73 colleges across the U. S., foreshadow better commercial radio for the future

WLRN
VOICE OF LEHIGH
640 KC





Student actors and musicians put on a show at Creighton University. University of Idaho's KUOI, like most campus stations, is student-maintained. At right, instructor explains technique of making transcriptions

on the air. All broadcasts travel to radios on the campus via the local electrical power line.

By the end of this year, KUOI will have strictly modern quarters in a new addition being built to the Student Union. But our visit to present quarters necessitated going through the university's ivy-clad engineering building, passing through two electrical-engineering laboratories and climbing two flights of stairs to an attic cranny that nobody seemed to want for anything else except a radio station.

We found eight students, all busy at work, in the 8 by 10 room. A coed, twice as pretty as her horn-rimmed glasses indicated at first glance, picked up a script and we were treated to an unusual women's fashion broadcast.

The program started off with the usual style chatter, but then came the piece de resistance — an interview with a male student. He thought the rolled-up levi fad was something that "shouldn't happen to a dog." And over a thousand coeds, mind you, were listening.

"Slacks? Well, they're different. It all depends on the chassis."

During a transcribed musical interlude, we remarked that the studio seemed a



little crowded. "If you think this is crowded," grinned an amiable student, "you should see it when we do a play. Sometimes the sound effects get bumped at the wrong time. We got in an unexpected clap of thunder at an inopportune moment one night."

From time to time, listeners call the station with requests—and critical comments. It is difficult for commercial stations to find out what their listeners want by calling them on the telephone and asking if they are listening to a certain program. But a college station is so close to its listeners that it can feel their pulse.

Harold Hough, general manager of commercial Station WBAP at Fort Worth, Tex., commented at a convention of the National Association of Broadcasters that "radio producers must do something about the forgotten man of radio—the listener." In college, the listener can't be forgotten. The broadcasters have to live with him. And college stations have another advantage over the big stations and networks. They can experiment—such as staging three-act plays with one act per night or holding a dance orchestra practice with all its chatter on the air—and have nothing to lose.

Ann Pike, who holds the position of assistant in radio education at Ohio State University, phrased it this way:

"Campus radio is frankly experimental radio. It need not be tied to conventional techniques for fear of miscarriage. It is a seedbed for new ideas."

Action was put to her words at Ohio Wesleyan University, where WES decided to try out a one-man horror show. A professor with a good story-telling voice recited original horror tales to the accompaniment of music and sound effects, complete with squeaking stairs. The experts who had predicted the show would be monoto-

nous sat on the edge of their chairs and ate their words.

The stations of 5 or 10 watts, broadcasting either through a common-carrier power line or through privately owned wires strung all over the campus, are of the peanut variety. But their possibilities are of the giant goober type.

First of the peanut parade was Station WBRU at Brown University, started in 1936. Like all pioneers, the experimenting students at Brown found the going tough. Use of the common-carrier power line was not practicable at Brown. That meant stringing wires from dormitory to dormitory. Fearing disapproval of their work by college officials, the students decided to do the stringing first, and talking afterward. There was plenty of talk.

When thousands of feet of wire added an unattractive droop to Brown's elms, the dean's office complained; the bursar's office warned that the insurance company wouldn't like it because of added hazards. The argument went on for two years, then came the intervention of nature, with whom one does not argue. A hurricane ripped up most of the trees in question, tore down the wires. The wires were then strung through heating tunnels, and everybody was happy.

The collegiate stations throughout the nation today enjoy a maximum of administrative backing and a minimum of interference. Because technically they do not go on the air, the stations have not been required to obtain FCC licenses. They have had to register with the FCC, but, within the limits of common good sense and taste, they have generally been masters of their own fate.

Last spring, however, the FCC proposed applying standard broadcast rules to the stations. The students groaned louder than

Coeds at St. Lawrence's Station KSLU practice art of control-room signaling. Performers are behind a window





Transcribing a "Voice of America" program at the University of Virginia for the United Nations to air to South America, Europe and the Far East



How does a sound effect sound? Stephens College girls do some experimenting. At all schools the broadcasts travel to campus radios via the local electrical power line. Below, actors on the air at the University of Southern California, with only listeners and no sponsors to satisfy



they do at the announcement of a quiz, for their stations are simply not designed to comply with the rigid regulations. Radio was about to "flunk out" of college.

The groans were heard — and echoed. Forty three congressmen, four state governors, 52 standard broadcasting stations, the National Association of Broadcasters, the National Association of Educational Broadcasters and dozens of other organizations, leading educators and radio executives speeded telegrams and letters to the commission. The FCC is preparing special regulations for collegians.

Unlike its big-brother systems, IBS does not broadcast programs nationally. Primarily, IBS serves as a clearing house for the scattered collegiate-radio empire. It is a nonprofit organization supported by its dues-paying members, with executives serving as nonsalaried volunteers.

Dramatic proof of the listening strength of IBS stations was provided when Station WPRU at Princeton University received a tip that a convoy of University of Pennsylvania students was headed for the Princeton campus, presumably to do a little painting job before the Princeton-Penn football game. Princeton students had decorated the Penn campus the night before, and a venging horde was riding the highways.

Station WPRU's announcer, a modern Paul Revere, warned the Princetonians over

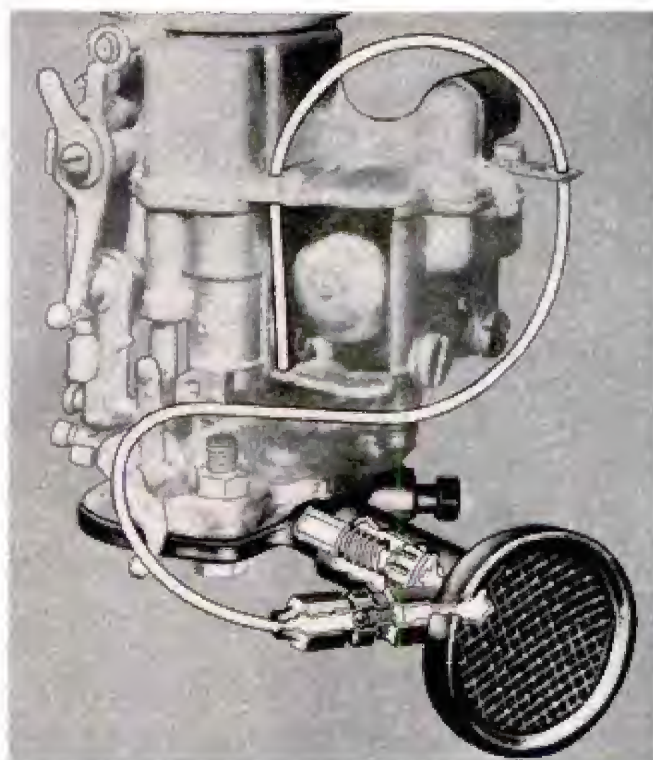
(Continued to page 232)



Italian Helicopter Is One of World's Smallest

One of the world's smallest helicopters is being flight tested in Italy. With its odd tail assembly and double rotor, the craft weighs only about 1100 pounds. Known as the

B.G.M. 2, it has a four-cylinder, 80-horsepower engine and a maximum range of 400 miles. The streamlined craft was built by Italian engineer Frederico Brondetti.



Gasoline Injector for Cars

Installed on the carburetor of any automobile, a gasoline injector is said to yield greater mileage and power. The accessory operates by using the manifold vacuum and thus is coordinated to the motor's demands. A high-speed stream of air from the air intake mixes with gasoline in a ratio of 15 to 1. The fuel then is atomized. The injector goes into operation only when demands are made on the motor; at cruising speed, the carburetor functions normally.



Three-In-One Photo Accessory

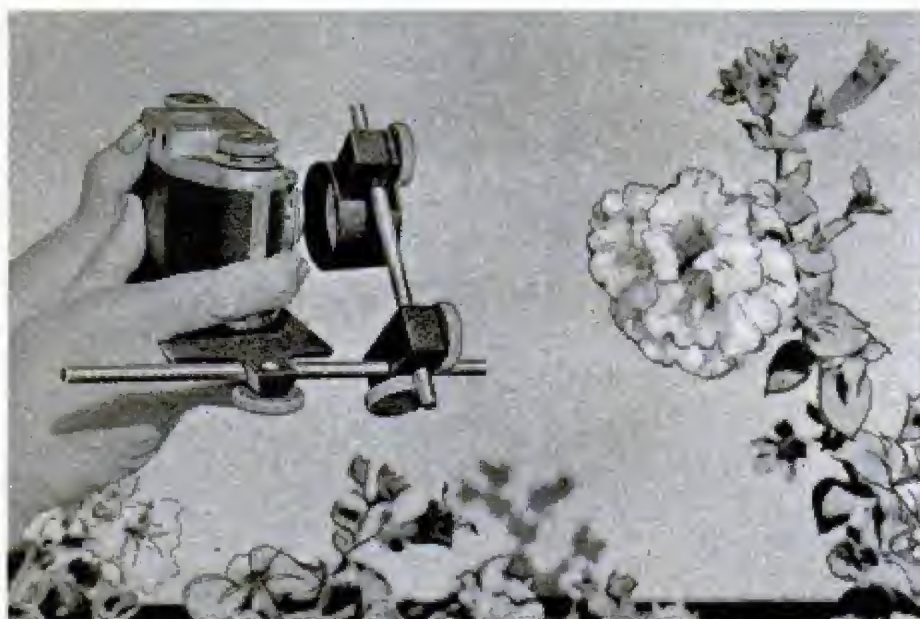
Combined in one compact instrument are a range finder, flash calculator and exposure meter to provide the photographer with all the data necessary for a good picture. The flash calculator and range finder are linked so that you read the correct diaphragm opening instantly after finding the range. The extinction-type exposure meter is designed to give simultaneous reading of "f" numbers as the photographer measures the light intensity.



Art Is a Shell Game to This Artist

Egg shells are the canvas on which Graham Dale, Hollywood artist, paints "portraits" of well-known persons. There are more than 100 personalities in his collection already and it's still growing. He drains the shell by punching a hole in the end.

Then he paints on the face, using a special acid paint. Hair, hats, neckties, ears and other characteristics of his subjects are made of paper, cloth, beads and wire. These are glued to the shell, producing an amazingly realistic "portrait."



Lens Holder For Close-Ups

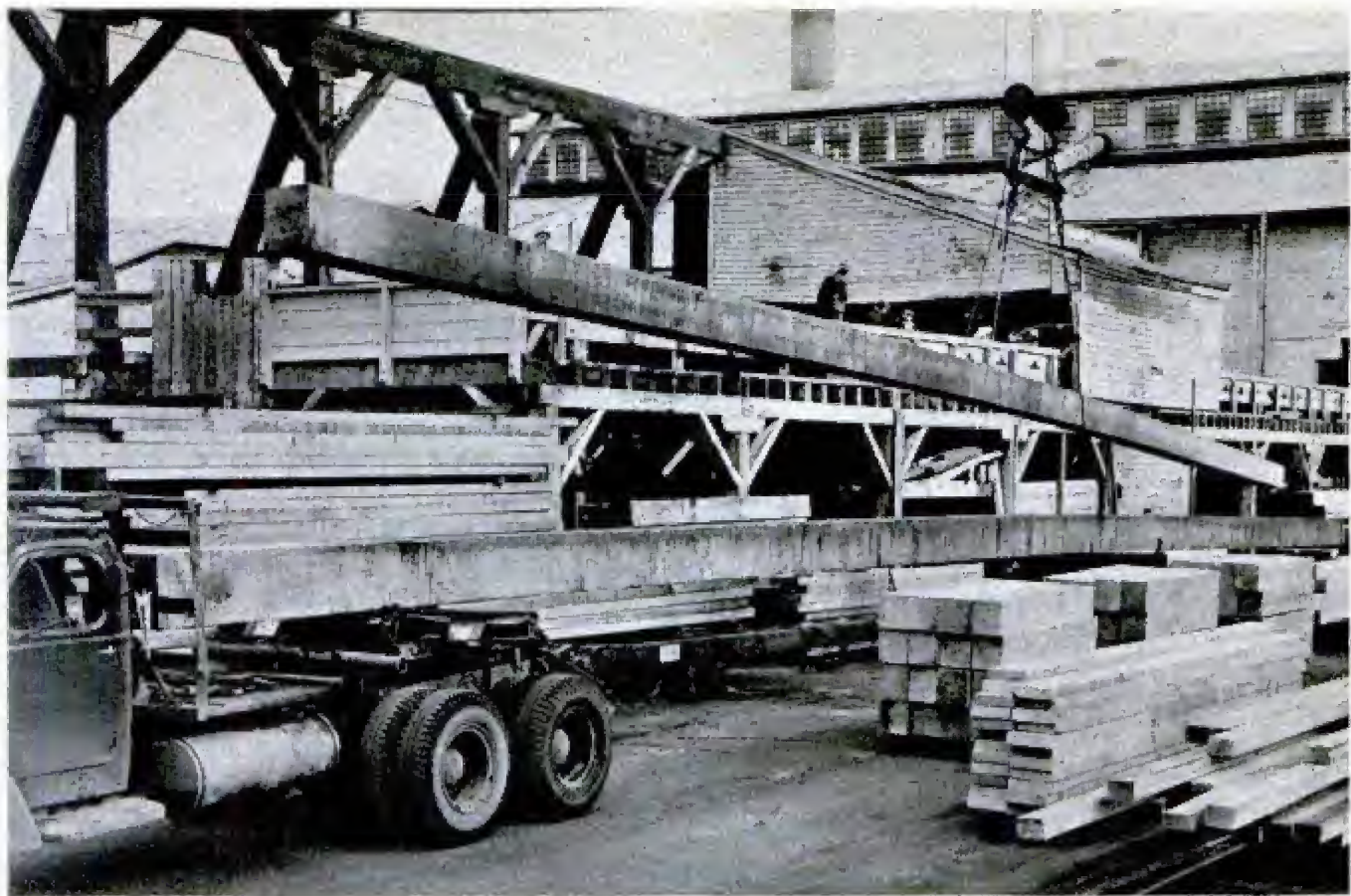
Simplifying the task of adding a supplementary lens to your camera for extreme close-ups, a convenient holder can be used with lenses of any focal length. The entire device, which consists of a support plate and two arms, attaches to the camera-tripod socket. The supplementary lens is snapped into place in the lens holder. The device can be used with either still or movie cameras.

Midget Typewriter

Virtually pocket-size is a midget typewriter developed by the Zeuzem brothers of Frankfurt, Germany. The midget, weighing only 2½ pounds, can be carried in a lady's handbag. There's one major difference between it and the conventional typewriter — the keyboard serves as the carriage.

Tests show that inaudible sound waves do not have a harmful effect on the human body.

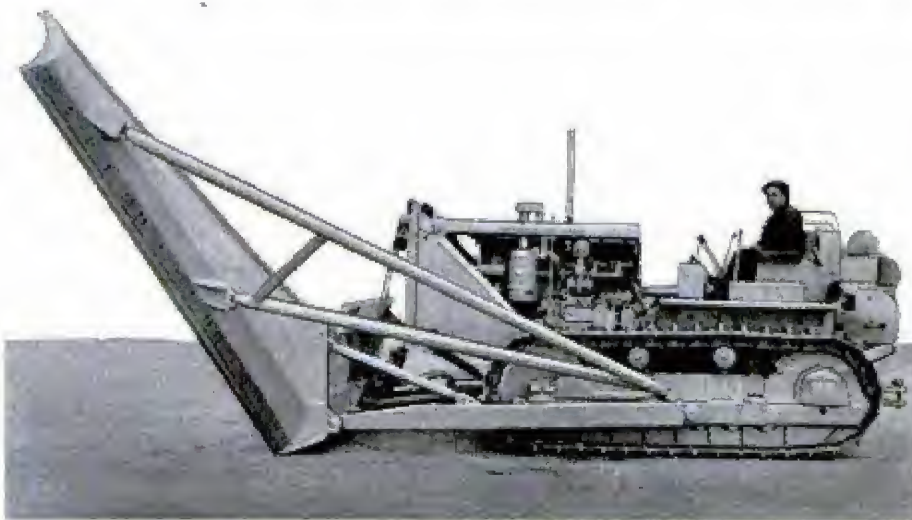




Keel Beams Cut 97 Feet Long

Two of the longest timbers ever handled by an old-time Washington sawmill recently were cut to size for tuna-clipper keels. The big beams were fashioned from

Douglas fir trees felled near Mount Rainier. They measured 97 feet long, 18 inches wide and 20 inches thick. The sticks were so long the sawmill operator had to cut a hole through one end of his big building before they could be finished and shipped.



Angledozer

Ditch sides are scraped at the proper angle by a tilting blade attached to a bulldozer. The blade is being used to trim the sides of the Friant-Kern irrigation canal in California's San Joaquin Valley. The offset blade is used in conjunction with a conventional blade, and runs out from the bulldozer for 16 feet. The operator can adjust the angle of the blade.



Popular Mechanics provides two sources of further information concerning articles published in each issue: the **WHERE-TO-BUY-IT** Index, starting on page 14, and the **WHERE-TO-FIND-IT** LIST, which is available to readers without charge from Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11

Look What's Happened to the Little Old

By Clifford B. Hicks

TROUBLE is brewing in the nation's school system and it's a lot more serious than pigtailed inkwells.

At the core of the problem are seven million war babies who now are answering school bells to spill through our jam-packed classrooms like a tidal wave. The problem is swirled to a crisis by the United States birth rate. Before Pearl Harbor about 2,300,000 babies joined us each year; now the rate has swelled to about 3,500,000, who annually begin their surge toward an already shaky educational system.

Faced with the problem of educating this wave of kids, old-timers are likely to look back on the days of the little old schoolhouse with nostalgia. That's the answer, they say. The old schoolhouse hammered out an education in the three Rs as solid as its bolted-down desks. What's become of the little one-room school?

Unfortunately, it's still with us. In the United States there remain more than 75,000 one-room schools, many of them dispensing a 50-year-old brand of education. More than 20 percent of our school buildings were erected before the Spanish-American War. These obsolete mind-factories are a dangerous problem in themselves.

What's to be done? The Federal Security Agency says we must build 300,000 new classrooms during the next 10 years to siphon off the wave of war babies, and at the same time replace 200,000 classrooms which will become obsolete during

One classroom for kids of all ages, and only a baseball for recreation—that was yesterday's school. Example of a beautiful modern building is Blythe Park School, Riverside, Ill., within a baseball-throw of a city park that is used as a playground. Low wall forms an amphitheater scaled to size of a six-year-old

Hedrick-Blessing photo



Schoolhouse!

that period. To do the job, the nation's 103,000 independent school districts will have to spade up a walloping nine billion dollars, four times the sum spent on school structures during the past 10 years.

There are bright spots, though. More than a few progressive communities already have tackled the problem with such enthusiasm that school buildings of a refreshing new type dot the countryside. Designed by such architects as Lawrence B. Perkins, Ernest Kump and Richard Neutra—the men who combine imagination with common sense—these schools reflect a revolution in education. They are serving

as guideposts for the many classrooms soon to be built.

Today, Johnny learns by action instead of by rote, and it takes a versatile building indeed to keep out of Johnny's way during his rip-roaring bursts of activity. Why shouldn't he read about Indians, then seize some poles and canvas to build a wigwam? Why shouldn't Sarah learn to add and multiply by dickering over prices in a schoolroom store? A dozen lectures by the teacher on traffic safety will never equal one 15-minute period with a make-believe traffic light and a pack of frisky children serving as cruising motorists while others cross a "street" chalked on the floor.

To carry out such a philosophy the classroom must be big, and about as changeable as a set of kindergarten building blocks. For too long we have tailored an educational program to the school building; now we must fit the building to the program.

One of the most advanced of these adaptable new schools is Blythe Park School, Riverside, Ill., which was designed by Larry Perkins after he had given every person in the community right down to the last freckle-faced kindergartner an opportunity to expound pet ideas on what the building should contain.

Blythe Park School looks like a

Teacher's dress seems odd today—and so does the crowded, muddy-brown classroom with its bolted-down desks. Contrast it with the big classroom of the Clyde L. Lyon School, Glenview, Ill., with its fireplace, light from both sides, pine walls that serve as tackboards and blond woodwork. Movable furniture can be shoved into one corner to increase play area

Hedrich-Blessing photo





Hedrich-Blessing photo

Every classroom of this school has its own outside entrance, cutting down the noise and increasing fire safety. When the windows are open, the baffles on the outer wall isolate the noises of each classroom

sprawling ranch-style house on the edge of a big green park. That's exactly what it is—a home away from home for the school kids, with a city park less than a baseball-throw away. When the community started searching for a site, the school board and the park commissioners came up with an ideal solution. The site is small and in a built-up area, but the kids have acres of playground in the neighboring city park. The park officials profit through use of the school for indoor programs and evening projects. Service clubs meet in the music room, the library serves the whole town and staid businessmen can use the big playroom for much-needed exercise with a volleyball or basketball. It's truly a community building, and it's just plain uneconomical not to use it when it stands available 'round the clock.

Because kindergartners are leaving their mothers for the first time, their room is

especially homelike. Drapes hang from windows, rugs provide a soft sure footing and over in one corner there's a real fireplace. Best of all there's plenty of space for roughhouse, balanced by a quiet corner in the sun for the story hour.

Each classroom has 30 square feet of area per child, more than twice as much as the old schoolmaster calculated as adequate in the little red schoolhouse. Walls of glass stretch from floor to ceiling. Perkins believes it's just as important to let vision out as to let light in. "When a kid's vision roams outdoors," he says, "his young mind goes along to the horizon and then right on around the world. This wandering of attention would have seemed idiotic a few years ago. But schools now try to do more than chain a child to a book—they develop his imagination."

Adjoining each classroom is a playroom where kids splatter paint without reprisal,

New educational tool teaches student to read faster. Screen slides down a page at a predetermined speed



Another instrument increases student's speed of perception. Numbers appear on screen for split second



where paste is paste instead of a nuisance, and where movies are screened. Each class has its own sink, drinking fountain and rest room. Tables with odd, trapezoidal tops can be shoved together in endless geometric patterns, thus providing a common table top for 2, 6 or 30 students.

The famed Crow Island School, Winnetka, Ill., which also bears Perkins' fine hand, probably did more to revolutionize school architecture than any building of the century. Winnetka children don't absorb the three Rs in predetermined doses. They learn from books, but they also learn from creative play, which whets their appetites for more "book learnin'." They soon discover that they must know how to read and write before they can learn more about aviators or firemen or how to take care of a baby. Ceilings are low, colors bright. Most of the walls are pine, soft enough so that the whole room becomes a tackboard. And outside each room is a walled-in outdoor classroom where lessons become fun on warm days.

Inside the little old schoolhouse, the tools of learning consisted of 35 screwed-down desks, a blackboard, a box of maps and an American flag. Woodwork and floors, desks and doors were stained a muddy "school brown" on the theory that dirt would match the background.

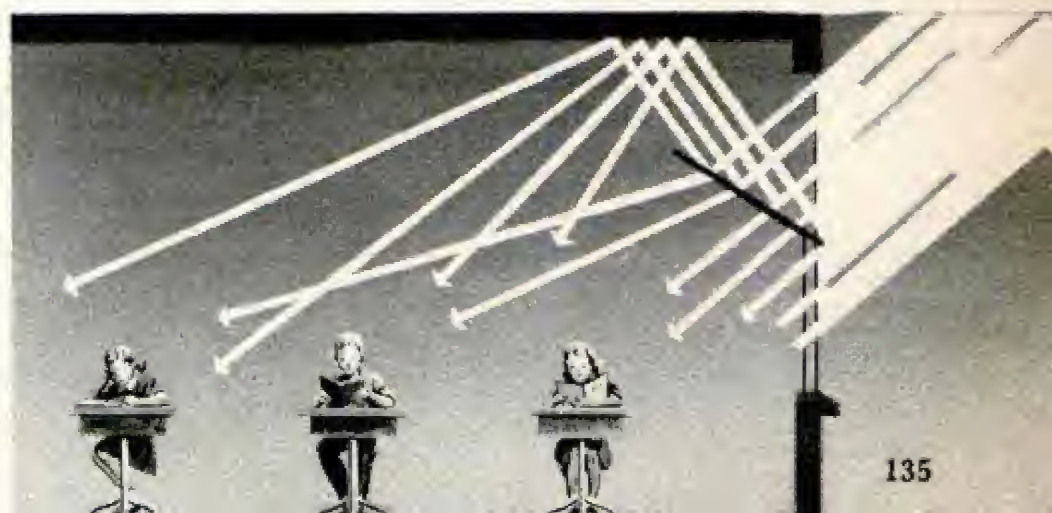
In the modern school, about all that's left of this traditional equipment is the American flag. Desks and tables can be shoved anywhere in the big classroom. Education finally has realized that the left-handed student is no freak, and permits him to turn his desk to obtain



General Electric photo
"Ceiling of light" sheds an even, almost natural light over the entire classroom, yet none of the fluorescent tubes can be seen. "Egg carton" panels made of metal do the trick. Below, modern high schools have several up-to-date kitchens where future homemakers learn to prepare meals
St. Charles Manufacturing Co. photo



Baffle above the windows helps solve the problem of casting light to the inside desks. Light bounces against ceiling, then deep into the room





Turnabout in Pittsburgh schools: boys learn to cook while girls, in a shop course, learn to repair furniture, fix leaky faucets and bad electric fixtures

Pittsburgh Press photos



Modern school desk is movable and adjustable for various kinds of work, molds student into good posture

American Seating Co. photo



light. He doesn't usually have to turn it, though, for light streams into the room from both sides.

In the typical old schoolroom, by actual measurement, the students near the wall received only one hundredth the light of the student next to the window. In a before-and-after experiment at an old-style school in Austin, Tex., 396 youngsters were examined and more than half were found to have visual trouble of one kind or another. The classrooms then were redecorated, relighted and the arrangement of seats changed. Six months later squinting had practically disappeared and the number of students afflicted with eye difficulties had been cut in half.

Architects use ingenious ways to pump light from one side of the classroom to the other. Directional glass blocks, installed just above the windows of Progress School, Ogallala, Neb., bend the light rays up to throw them far into the corners. Reflecting shades at the windows of other schools bounce the light against the ceiling where it is diffused throughout the room.

Every stick of wood in the modern classroom has a light, nonglare finish, for educators and architects have learned that too much contrast can do just as much damage to the eyes as too little light. The blackboard no longer is a board or a slate, and it isn't black—it's a textured green glass. Experiments have proved that white against green is easier to read, with less eyestrain, than white against black.

Teaching aids and play equipment are everywhere in the new school—movies and textile colors, stainless-steel jungle-gyms and finger paints, indoor fireplaces and out-

Small site dictated a two-story building here, so the upper corridor was placed outside the new school

Kump & Falk, architects; Roger Sturtevant photo



door wading pools. Even television.

Two new educational tools—the tachistoscope and the reading-rate controller—are finding widespread use in modern schools. The tachistoscope increases the speed of perception. An object, which may be a group of numbers, words or pictures, is flashed in front of the student for a split second. As he learns to see faster, the exposure time is shortened. After practice, some students can develop their speed of perception remarkably. One student learned to see and repeat a group of seven figures after they appeared for only one thousandth of a second. The other instrument speeds the student's rate of reading without any reduction in comprehension. A printed page is placed in the instrument. Then a screen moves down the page, covering up the text line by line at a predetermined speed. As the student becomes more adept, the screen is set to move faster. Practice with the instrument has speeded some students' reading rates as much as 300 percent with no loss in comprehension.



Hedrich-Blessing photo

Trapezoidal tables can be shoved together in endless patterns to provide a common table top for any number of children. Below, at the touch of a button a big automatic door slides across a gymnasium to separate it into two private play areas.



Folding tables and benches in some new schools appear from the walls of gyms or school corridors to convert them to lunch-rooms. Bleachers in gyms disappear at the touch of a finger, making twice as much room for play. At the Downers Grove, Ill., high school, huge automatic doors glide across the big basketball floor to split the area into two separate courts for boys and girls. Concealed irrigation systems keep athletic fields green despite the pounding of cleated shoes.

In many of the new schools each classroom has its own exit, reducing fire hazards and muffling the commotion generated by several hundred young dynamos. At the Consolidated School, Palatine, Ill., baffles on exterior walls stand out a few feet, dividing off the classrooms and soft-pedaling the group sounds of each room.

A half-dozen or more kitchens, complete with refrigerators and stoves, are built into modern high schools. In Pittsburgh the board of education has gone even further—boys are turned loose in the kitchens to learn how to prepare meals, while girls are given a special “how to do it” course in the shops to prepare them for the day when they can’t persuade a tired husband to do a lick of work around the house.

Some communities, watching the flood

of war-born kids lapping up around the foundations of their school systems, have come up with novel emergency measures. Tacoma called in architects Mock and Morrison and had them design movable classrooms, bright and airy, warm in winter and cool in summer. When a particular school needs more space and needs it fast, the classroom rolls up to the door. It is lowered to the ground and utilities are piped in from the existing building. Next year, if some other school district starts popping its seams, the building will be hoisted and trundled across town again.

When the school superintendent today looks over a diagram of his city he sees nothing but headaches. There are population lumps and sags all over the map. Since the war more than 17,200,000 new American families have been started, and a good many of them have settled—with kids the same age—in new housing areas. On the map they pop up as those 500 new families out on the edge of the city on a site that was an open field three years ago.

Selecting the right site for a new school thus is all-important. Even the finest building erected on the wrong site can become obsolete surprisingly fast.

Among trends in modern school design: Smaller “play sheds” are replacing huge

spectator-type gyms. The theory is that it’s better for every kid in the school system to have adequate physical training than to provide one big building where 5000 people can watch five local athletes swish a ball through a basket. Auditoriums, too, are smaller today. In one of Perkins’ schools, the stage apron is made of big movable blocks, so the stage floor can assume any of countless shapes and sizes.

Most new schools are one-story buildings, and many are so designed that new classrooms can be added later. In some buildings a large-roofed play porch gets the kids outside even on rainy days.

Although some furniture and shelving is “built in,” there is a trend toward making almost every piece of furniture movable. Bookcases and cabinets are on easy-rolling wheels so the room arrangement can be changed within a few seconds. Movable metal walls make the entire floor area fluid. Two men can move a new 21-foot partition to another location in less than an hour.

These facilities, which weren’t even thought of when the little old

(Continued to page 242)

Playroom, just off classroom, provides area where enthusiastic young artists can splatter paint and paste without reprisal

Hedrich-Blessing photo



Gears Made of Plastic Outlast Steel in Test

So tough that it outlasts steel when formed into gears, a new plastic, developed by United States Rubber Co., can be produced with varying degrees of flexibility. In one application, a drive gear on a heavy-duty lathe was molded of the plastic, called Enrup, and after more than six months of use it showed no signs of wear. Because it can be molded to close tolerances, the plastic eliminates many finishing operations. It will bridge the gap between brittle hard rubber and elastic soft rubber and can be produced to match the flexibility of either of these extremes as well as the varying degrees between them. Enrup is fire resistant and a good electrical insulator. It is expected to be used for battery cases, gears, water-pump and fuel-pump parts and many other items.



Swinging Lamp Exposes Film To Photograph Sound Waves

Actual patterns created by waves of sound have been recorded on film at the Bell Telephone Laboratories. The equipment consists of a tiny microphone and a neon lamp, both mounted on a swinging beam which scans the wave field. It is this scanning which builds up a picture during a time exposure, in much the same way television images are formed. One of the first uses of the equipment was to test the focusing effect of an acoustic lens on waves emitted from a horn. Sound was broadcast from the horn through the lens. The waves beyond the lens then were photographed.

Knockout Punch

Electricians pack a powerful punch that speeds the work of cutting holes in control boxes when they use a portable hydraulic ram with a 10-ton capacity. The ram can be used with hand punches or, if desired, complete punch kits can be purchased that are designed for the tool. The hydraulic unit and punch are connected by a flexible hose, enabling the punch to be used in places that would be inaccessible to more bulky equipment. It is also easier to use in awkward positions because there is no wrench or hammer to swing.

☐ Probably the world's deepest laboratory is 7000 feet underground in a South African gold mine where doctors study the effect of subterranean heat on the workers.



when the earth shakes— You're Safer in Your Car

By Juan Pastor



While several persons were killed by falling rubble on this street, the passengers in this truck were unhurt. Below, workers begin removing the ruins of a church where 85 persons, most of them children, died



I COVERED the disastrous earthquake that hit Ecuador last year, a devastating horror that killed over 10,000 and left at least 100,000 homeless. Fifty-three towns and villages were badly damaged and some were totally destroyed.

Pelileo was struck the hardest, as this thriving town seemed to be the exact epicenter of the quake, and not one building was left standing. No atomic bomb could have wrought greater structural damage than Pelileo suffered. I searched in vain for a building that might have, somehow, escaped the ravages of this trembling terror which killed more than 90 percent of the inhabitants who were indoors or standing within range of the crashing walls.

Having lived in Ecuador for more than a decade, I was not unfamiliar with earth tremors and had been told, repeatedly, that the best spot to go at the first indication of a quake, assuming you are not well clear of buildings, was in an archway—the theory being that while the walls might crumble, the arch supports of stone, cement or heavy beams would very likely afford sufficient protection to save your life. Don't you believe it, unless, of course the quake is a slight one.

The safest place to be when the earth shakes violently is somewhere else—the farther the better! But assuming that this is impossible, that circumstances—call it luck—put you on the spot, then let me give you some advice based on my inspection of several towns and villages immediately after the quake:

Get into your car. If it has an all-steel body, it's your safest bet by all odds. Most earthquakes do give a moment's warning. This one opened at 2:10 p.m., with a slight tremor. All survivors state that they felt this initial movement. Some paid little or no attention since mild temblors are frequent in some sections of the Andean slopes and highlands. Others either went out into the open street or sought shelter under an arch. Only a very few of these lived and those who pulled through, did so through sheer good fortune. Exactly 45 seconds after the warning tremor, the entire valley in which Pelileo is located dropped from six to ten feet and this was followed at once by a shaking so violent that absolutely

nothing in town except the cars and trucks held together.

In many places, earth cracks opened, swallowing people and livestock, then closed again. But none of these crevices was more than three to five feet wide. No one knows how deep. One truck actually straddled such a crack, its occupants screaming in fright as they saw the ground open up.

One of my photographs shows a sedan. A man and his wife were sitting in the front seat when the quake occurred. At the first slight tremor, the woman opened the door on her side and started to get out. Her husband yanked her back, slamming the door after her, and seconds later the car was buried under tons of rubble, stone and beams from the building next to which it stood. Neither of them was injured though they spent 34 hours trapped in the car without food or water before being dug out by a rescue party.

A truck driver tells of his freakish experience: "I was driving along at 25 or 30 miles an hour, going up a long grade. I did not feel the first slight tremor, probably because of the motion of the truck. Suddenly, the whole truck leaped upwards, how far I do not know, and then turned turtle, falling upside down. One man riding behind was thrown clear. There were three of us in the cab and we suffered slight head contusions and bruises, nothing more."

Another truck, driving slowly along a

narrow Pelileo street, was stopped short by the cave-in of houses on both sides. Fortunately, they were low, one-story dwellings, with the result that the truck was not completely covered (see photograph). But three bodies were unearthed in this same short street, evidence that these people had run out of their homes seeking sanctuary in the open and, having no protection such as those in the truck, they were knocked down and engulfed by the rubble.

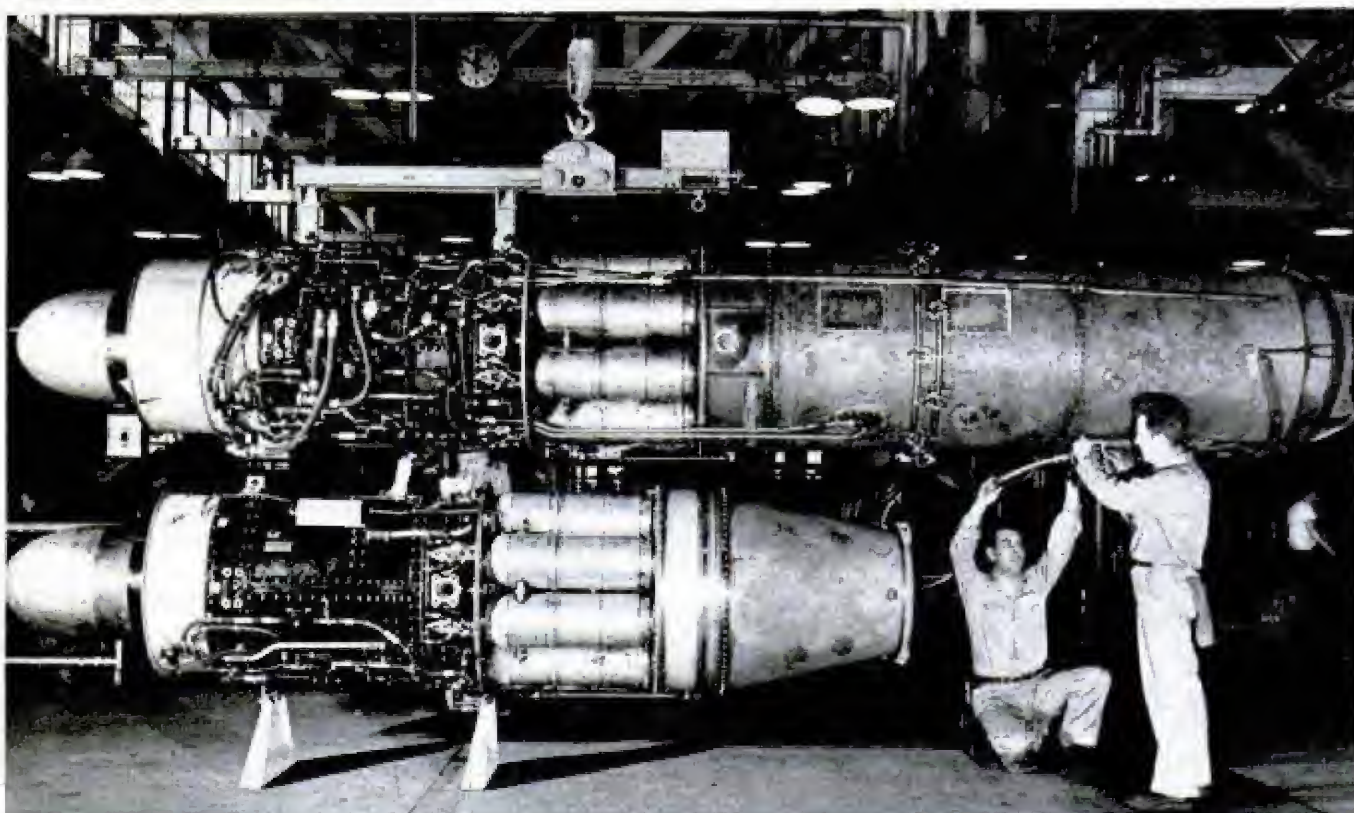
Not one person who was in an all-steel body of either car or truck was seriously injured, and I saw at least 15 cars in various stages of burial, most of which had been occupied at the time of the quake.

I have said that every building and house in Pelileo was destroyed, and this is quite true. Yet it was not infrequent to find roofs still intact even though the walls had crashed in or out. This was probably due to the initial dropping of the valley which caved in the walls but occasionally left the roof sitting there, virtually level with the ground.

During the four days that I spent in Pelileo, Ambato and other quake-ridden towns, I slept in my car, for recurring slight tremors kept up at the rate of 15 to 20 a day for several days after the disaster and none of us knew, from one moment to the next, when another major quake would come. I had learned, not as a scientist, but by simple observation, that my car was the safest place to be.

Shown here partly uncovered, this car was completely buried in the quake, but its occupants were unscratched





Top photo courtesy North American Aircraft Co.

Fastest Plane Increases Power

Burning of additional fuel in the tailpipe of its General Electric jet engine gives added power to the F-95A, newest version of the fighter holding the world's speed rec-

ord of 670 miles an hour. Automatically controlled "lips" in a nozzle at the end of the pipe gain maximum performance from the engine under varying flight and power conditions by changing the area through which the hot gases must escape.



Tile-Laying Kit

All the tools needed in laying an asphalt or rubber-tile floor are included in a new kit. The tools consist of a knife, notched adhesive spreader, awl, chalkline and chalk. The kit also contains step-by-step instructions for laying the tile, including diagrams showing how the tile should be arranged and applied to rooms of various shapes.



Tip to Moscow: You Can Do It Better With Gasoline

When the Nationalist coastal blockade cut off gasoline imports into Communist China, the Chinese resorted to charcoal as a fuel for thousands of their vehicles.

Busses which were converted to use of charcoal sported big burners behind the rear panel. Tubes ran up over the bus to a feed-in mechanism for the carburetor.



Vibration Detector

Invented by a 22-year-old undergraduate at John Carroll University, a portable vibration detector provides a simple means of measuring vibrations in buildings and other structures. It weighs only six pounds and is essentially a small version of the seismograph. Its basic parts include a pick-up mechanism, an amplifier and recording circuit. The circuit "holds" the peak impulse on the dial, assuring the operator that he reads the most intense vibration. The inventor, Edward F. Carome of Cleveland Heights, Ohio, worked on the detector's design for eight months before perfecting it.



Desk for Drivers

Salesmen and other motorists who must use their cars as offices can jot down notes on a desk that fits over the steering wheel. The portable desk slips into place and is held at a convenient height and angle. Inside the desk are compartments for stationery, stamps, order books, pencils and other supplies. It can be carried like a briefcase with a handle on the top.

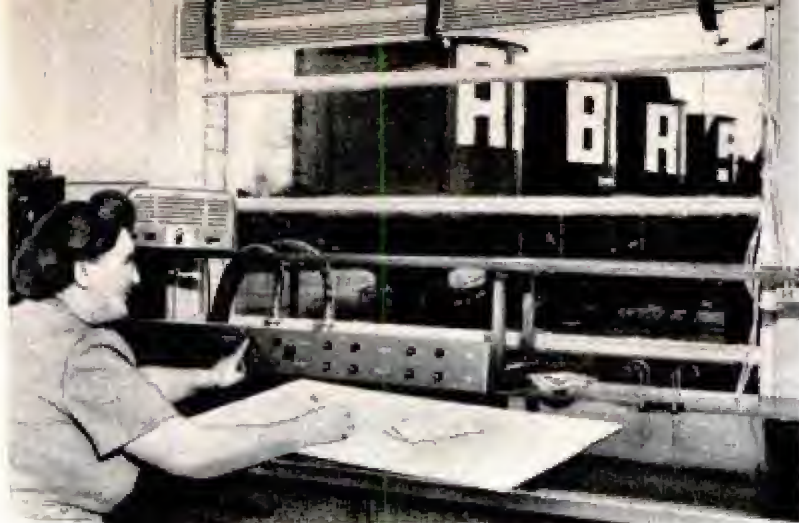
Escape holes can now be cut through the walls of crashed airplanes by a new-type explosive, specially shaped to concentrate its punch in one direction.

RAILWAY COAL CARS



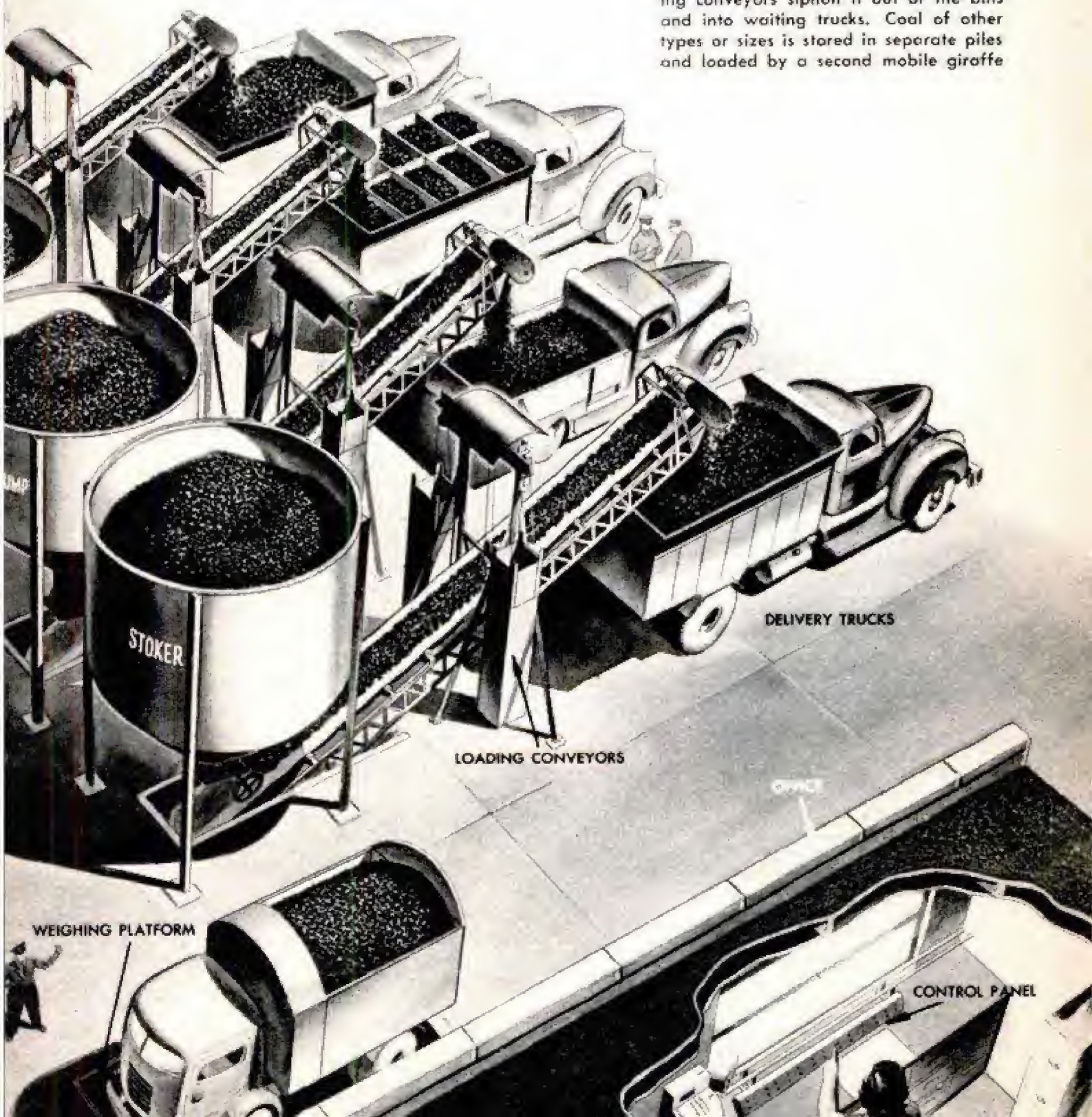
Below, empty trucks rumble up to the four bins, buttons are pushed in the office and the selected types of coal pour into the trucks. No one touches the coal after it leaves rail car





Push-Button Coalyard

Spic 'n span as a grocery store is a coalyard in Tacoma, Wash., where weird machines automatically unload the fuel from rail cars, sort and grade it, deposit it in bins and then load it on trucks when it's needed. One operator, above, can run the entire coalyard with push buttons. The coal drops into an unloading pit from the rail cars. It then is moved by a conveyor belt to a point opposite the bins, where a mobile "giraffe" hoists it into the proper bin. Loading conveyors siphon it out of the bins and into waiting trucks. Coal of other types or sizes is stored in separate piles and loaded by a second mobile giraffe



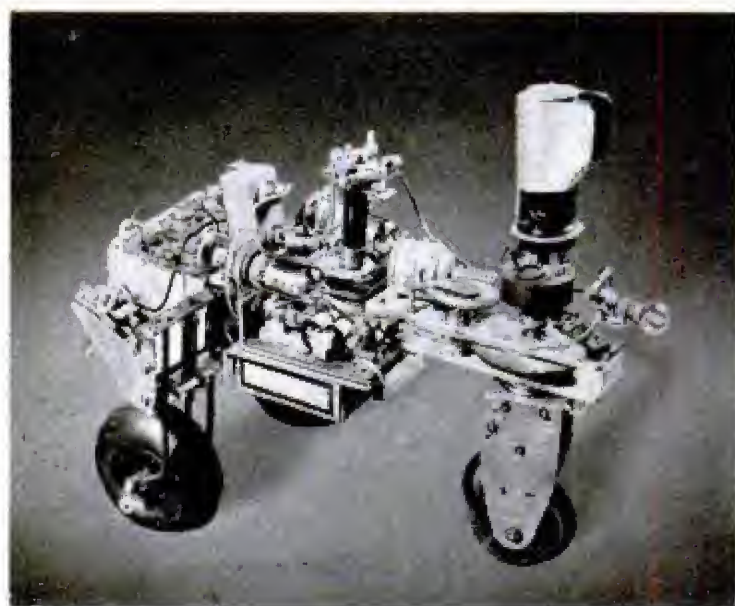


Consolidated-Vultee photo

Bomber Carries Spare Engines

Four spare engines can be hauled by a giant B-36 in two streamlined pods that hang from its bomb bay. Each is 32 feet

long and 8 feet in diameter and together they weigh 25,000 pounds when loaded with engines. Increasing the utility of the bomber, the carriers can be quickly removed and placed inside the airplane.



Mechanical "Thinking" Turtles

With a couple of old gas meters, some batteries and electrical parts, a scientist has built a pair of unpredictable mechanical turtles which are aiding in a study of how animal and human brains work. Dr. Grey Walter of the Burden Neurological Institute, Bristol, England, made the robot tortoises. Each has a snout on its back containing a photoelectric cell. When the batteries are turned on, the snout slowly revolves, searching for the strongest source of light in the room. This action also revolves the front wheel of the tricycle un-



dercarriage, and the turtle wanders from side to side. As soon as it "sees" the light, the snout stops revolving and the rear wheels start turning to move the turtle forward toward the light until it strikes a piece of furniture or some other obstacle. Then with a growling of machinery it moves at random from side to side until it once more "sees" a clear path to the light. The two turtles now have two simple reactions—response to light and avoidance of obstacles. Doctor Walter plans next to give them a 15-minute electronic memory, and a primitive learning ability. He won't predict exactly what they'll do then!



Rolling Truck Doors

Particularly adapted to delivery trucks in congested areas, rolling doors that disappear into the body sides are making their appearance in London. Vehicles using them in place of outward-opening hinged doors require less parking space for loading and unloading. The risk of accident from doors opening outwards onto the street or sidewalk is also eliminated.

Rosier Cheeks for Apples

Treatment with a new spray solution gives apples 40 percent more color, Cornell University experiments indicate, and the red is more intense than on untreated fruit. The spray, which is not commercially available as yet, doesn't add the extra color, but it increases the output of red pigment in the apple.



Bodyless Wheelbarrow

Because it has no body to limit its uses, a steel wheelbarrow chassis will haul just about anything from storm windows to ash cans. It will carry garbage cans, lumber, firewood, grain sacks and many other items of all sizes and shapes. Weighing only 12½ pounds, the wheelbarrow can be hung on a nail in the wall when not in use.

Store's Information Booth Has An Electronic "Clerk"

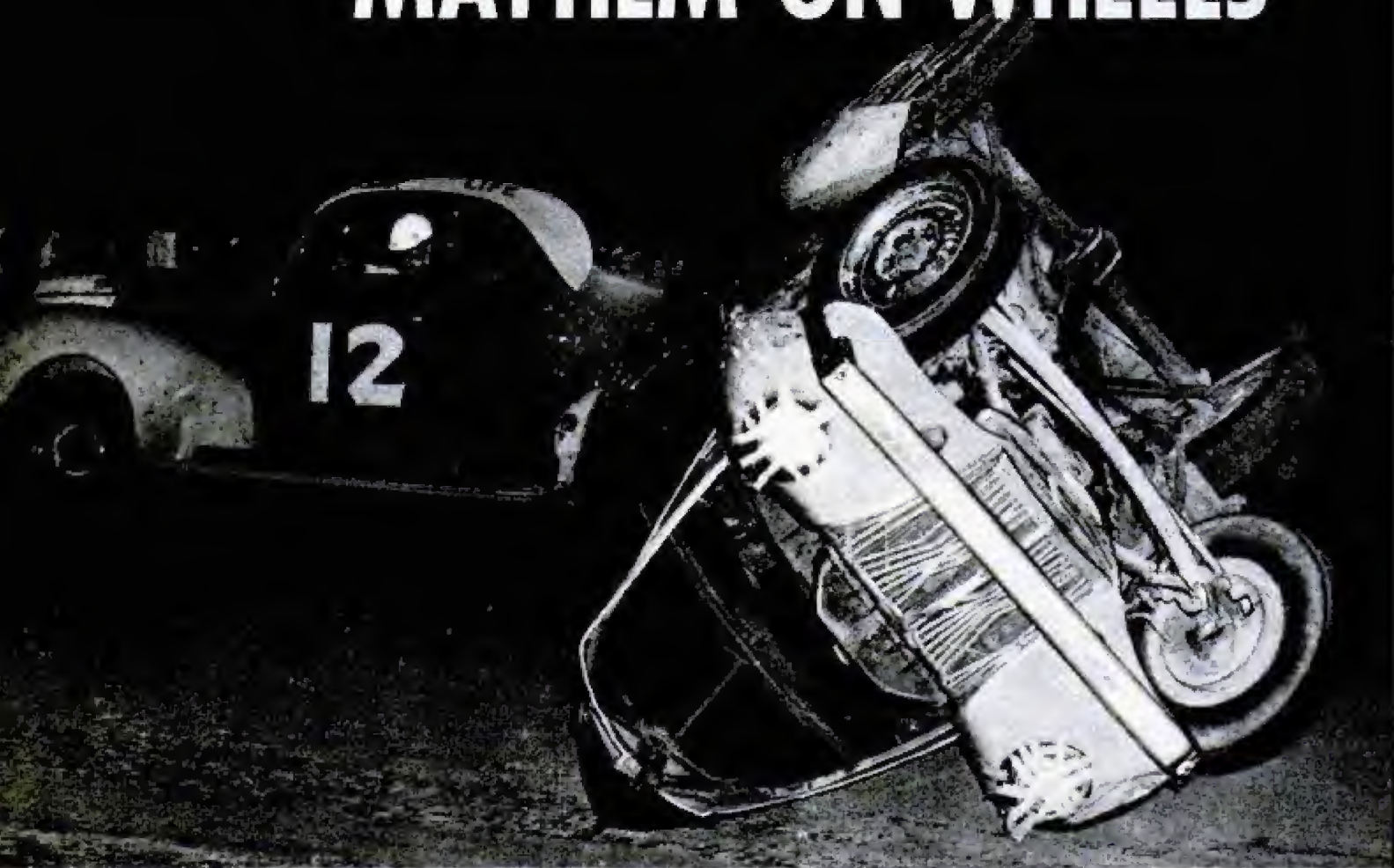


Shoppers, looking for a certain item in a large store, get quick, accurate information from any of several wall-mounted communication units scattered throughout the building. These units, parts of a two-way communications system, are hooked up to the store's information center. When the customer wants some information, she presses a button to call the operator and asks the question into the built-in microphone. The operator, who knows where the customer is because each unit is identified on the control panel, gives her exact instructions over the two-way system.

☛ Forest fires in the U. S. last year burned over more square miles than the combined land areas of Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware and the District of Columbia.

ons usually get there too late for the excitement. Those who pack the stadium for the stock-car races are sure to eyewitness the wreck. It's

MAYHEM ON WHEELS



Over he goes! Thrills like this are packing in the customers at stock-car race tracks all over the country

By John Christy

TAKE THIRTY-ODD passenger cars of varying ages, put them on a quarter-mile track and turn the drivers loose with instructions to "put on a show for the folks." The resulting mayhem, a cross between a legitimate auto race and a thrill show, is a stock-car race.

Although not a new phenomenon, stock-car racing during the past year has taken an upswing in popularity, surpassing such drawing cards as hot rods and midgets for crowd appeal.

The main crowd appeal seems not to be so much an interest in speed as in the urge for some kind of destruction, the more violent the better.

Perhaps another big reason for the record attendance lies in the fact that here at last is a race car that the people can understand. There is no secret about these cars. There are no special engines, no talk of overhead cams, tube frames, quick-change rear ends and other unintelligible equip-

ment. These are just cars like John Q. drives to work.

Modern family buggies were never designed as race cars. With their slow steering and soft suspension, they have about as much stability as a camel on a log jam. That's why there's excitement at the track!

On a track designed for midget racing, these erstwhile family busses handled by eager young race drivers anxious to prove their driving ability or lack of it, keep the crowd on edge all night. The ripped fenders, spins, rolls and general destruction make even a tough cab driver shudder. When the natural talent of these incipient Barney Oldfields for slashing and plain and fancy "boogering," or power sideswiping, is compounded by an offer of repair money, the mass destruction would delight a lunatic with a wolverine complex.

The races, staged along the traditional lines of the sprint programs of the midgets and hot rods, are run off in a series of heats,



After an end-for-end flip, this stock car slid more than 50 feet on its nose. The driver? Not a scratch!

a consolidation race for the slower qualifiers and two feature events. Occasionally, there is a culminating "super feature." The same rules that apply to other types of racing apply to the stock cars with the exception, at least in the midwestern circuits, of the flag regulation.

The big difference is that at no time during the race is the yellow or "no passing" flag displayed. This, in other races, is used when a spin or other mishap partially blocks the track. In stock-car races, if the track becomes so cluttered with debris that it is completely impassable, the red or "stop" flag is displayed. When the track is cleared, the race continues with the cars in the order in which they were stopped.



The '39 Ford has been a favorite stocker. This one lasted an entire season, winning two championships

The only other time an event is halted is in case of injury or fire.

In some races, particularly the consolation, this produces the effect of an obstacle course as the drivers worm their way at top speed through the torn fenders, bumpers and wrecks of their less fortunate competitors. Some don't quite make it and the course gets tougher as the race proceeds.

At many tracks the pit area is continually bathed in the blue light of a welder's arc. A welder is in constant attendance to nurse the cars through the race. It is quite common for a car to become so battered that it could model for an insurance-company advertisement, but it still bounces back in competition for the feature event.

Nobody won this argument. Both cars went through the fence and out of the race. Crash helmets, safety belts and luck kept the drivers unhurt





Its radiator smashed, this wrinkled racer filled up with steam as the driver exits through a glassless window

Pit mechanics are expected to do in minutes what the ordinary garage mechanic would not try to do in days.

Stock-car drivers, like their more conservative brethren of the hot rods and midgets, follow a circuit of tracks. One night they'll be in Chicago, the next night they run in Milwaukee, then Rockford. After that there is another dash across country to another town. In some cases, the haul from one track to another is 100

miles or more. Much the same schedule is followed all over the country.

Traveling the circuit is not easy. Since the cars require constant service, the hauls are usually made at night, after the evening race. Repair work is done in the next town before the race. One driver was asked if he ever got a chance to get a full night's rest. "Oh, sure," he answered. "We sleep Mondays."

Since the hot rods went big-time the

Rolling over so violently that he lost his goggles (left), this driver and car still raced again that night





Soldier Field Stock-Car Racing photo

Expectantly, the crowd watches two drivers desperately try to avoid a collision as they skid around the turn

"stockers" remain the last chance of the amateur driver to prove his stuff. Some of the screwball tactics designed by over-eager young chauffeurs to make an impression give officials the howling jitters.

Main danger in this type of competition is fire. A fuel explosion can turn one of these heaps into a rolling crematorium if care isn't taken to prevent it. Promoters and officials grow ulcers like mushrooms worrying about this but some drivers don't bother about such minor details.

One enthusiastic newcomer, noted for driving "over his head," discovered that he wasn't getting enough fuel through to the engine. After considerable thought he came to the conclusion that an auxiliary fuel supply was what he needed. Taking a five-gallon can of 91-octane aviation fuel cut with methanol, he connected it to his fuel pump and wired it firmly in place.

He had completed two laps of the consolation when his car erupted like a miniature Bikini. After a seemingly interminable struggle with his safety belt, the young Vulcan finally emerged, singed but perversely pleased at the effect of the whole thing, to watch his charred chariot towed away by the track crew. What gave officials rise to doubt the compos of his mentis was the location of his extra fuel tank—on the frame, wired to the exhaust manifold.

Although it would seem to the uninited that the damage to life and limb would be in direct proportion to the automotive damage, injury is extremely light, bruises and an occasional sprain being the most common.

Steel tops, safety belts and the use of crash helmets are strictly required. Glass is removed or taped to prevent shattering

and shatterproof goggles must be worn. In spite of this, insurance companies are reluctant to cover the participants.

The automotive-casualty figure is terrific. After a few weeks' competition, the cars are a mass of welding beads and baling wire. Fenders are pared to the minimum. Some of the cars have crumpled tops while nearly all have at least one door so badly battered that it will not open. Average life expectancy of a stock car is six to eight weeks. Before a car can enter a night's racing, it is inspected and has to have all fenders, doors and other major parts in place. It must look like a normal car when the racing begins—after that anything goes!

From time to time new cars make their way into competition. One such, a brand new Chevrolet, made its appearance late last season. The pretty little job was in perfect shape. It was immaculate, without even a scratch on the finish. The audience, stunned by its appearance, became absolutely still. Then, as with one voice, they let out a mighty cheer.

The other drivers, feeling that here was either a complete idiot or a rank amateur, undertook to warn the newcomer with gentle bumps and near misses as the race proceeded. But when the driver showed up for the next heat in spite of these warnings, the boys took no pity. He was slammed from one side of the track to the other; he was ground against the wall; he was spun out on the turns and broadsided not once, but four times and he still came back for more.

By the end of the evening, one door was battered shut, the rear bumper was missing, both front fenders were ripped and

(Continued to page 236)



Part-Time Traffic Cop

Traffic during rush-hour peaks and at school crossings is directed effectively by a portable automatic signal. The signal cylinder is moved by a coil spring 11 feet long



that will operate for 24 hours when fully wound. An adjustable time clock controls the time interval for signals. When not in use, one man can move the signal stand on retractable rubber rollers that are concealed within its base.

Carbon Dioxide Injected Into Mine Kills Stubborn Coal Fire

Carbon-dioxide gas has extinguished a stubborn fire in an Illinois coal mine, according to the U. S. Bureau of Mines. The successful battle will lead to the use of CO_2 in fighting other mine fires, the bureau indicates. In the Valier, Ill., mine, temporary seals to prevent air from reaching the fire

were blown out twice by gas explosions. Flooding was impractical because of the height of the airway. Eight days after the fire had started new seals were erected and carbon-dioxide gas was injected into the fire area. Temperature tests indicated that 11 hours later the fire was out.



Berry Farmers Sit Down at Work

Farm laborers, working on strawberry plants, sit down in the shade as they work, thanks to a rubber-tired, hand-propelled cart. The cart also provides space for carrying seedlings during transplanting and baskets during harvesting. An umbrellalike cover protects the plants and berries as well as the worker from the hot sun. Power is transmitted to the rear wheel by a hand lever and ratchet. There is even a spot for a portable radio to entertain the worker.



↑ Stacked here are all the parts needed to make the garage. The structure can be built on a concrete slab or set on cedar posts



← Base rail is a rectangular aluminum tube just the size to take a two-by-four. Short lengths of wood are installed at joints



← After walls are up the roof panels are slipped into place on strong ridge member. Tension cleats hold the panels together

Below, left, heavier beam slips into sockets in the sidewalls, thus making the opening for the door exactly the right size



Garage, built of panels held together with cleats, is strong and can be made any length

PREFAB ALUMINUM GARAGE

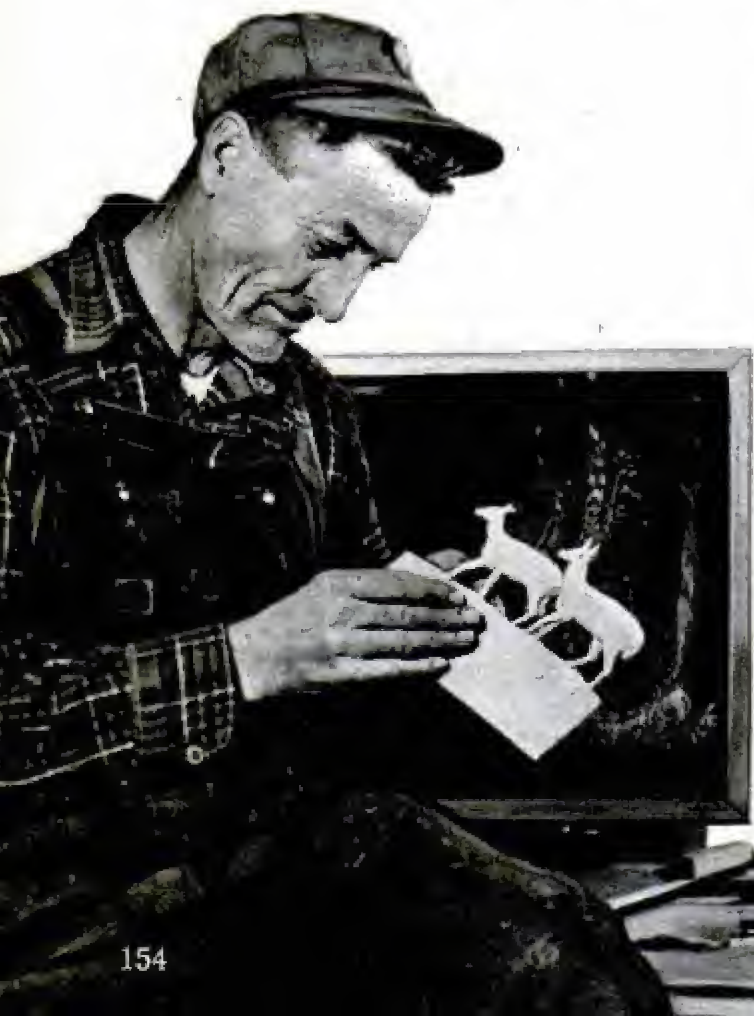
Overhead door has spring that works like curtain shade to raise door at touch of a finger





With quick strokes Pearson completes another unique landscape which combines painting and woodworking

Painting in Three Dimensions



WITH a jackknife and an artist's brush Bill Pearson of Sartell, Minn., can create a three-dimensional picture that seems to pop out of the frame toward the observer. Pearson, a carpenter, has combined his trade with his talent for painting. His unique forest landscapes are made of carved wooden figures which are blended into a painted background. In creating a picture, he paints the scene on a piece of cardboard with ordinary oil paints. Then, using small bits of shrubbery, he "plants" trees and underbrush on the painting. Bears, deer, duck, large trees and other foreground figures are carved or jigsawed from pine boards, then shaped with a knife and chisel. The finished figures are worked into the picture so that they stand well away from the background. To make the picture even more unique, Pearson paints shadows of the wooden figures on the background. His three-dimensional paintings have sold for as much as \$200.

Artist carves wooden deer which will be foreground figures, mounted well in front of the painted background



In the finished painting the deer and the foreground setting seem to jump out of the picture to give an illusion of depth. Below, drawing shows how landscape is built in layers, with large trees carved from wood





Steep-Climbing "Air Horse" for Farmers

Designed to carry heavy loads out of rough, "postage stamp" size fields, the new Piper Super Cub is airborne after a run five times its own length. A novel tandem-wheel landing gear allows operation on rocky terrain, soft sand and mud. The front tires are inflated to only four pounds, permitting them to climb up and over obstacles that would stop a conventional landing gear. For its primarily agricultural role, the plane can carry 1000 pounds of crop dust or 80 gallons of liquid spray, and "hover" safely at just over 30 miles an hour.



Householder's Ark

Pontoons that the British used as temporary bridge supports during the war are being made into dwellings for house-hungry Londoners. Some are being put on lots, others used as houseboats and the remainder are being converted into pleasure craft. The pontoons are 20 feet long.

Information not listed on articles in the index frequently is listed in the WHERE-TO-FIND-IT LIST, available without charge from Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Illinois



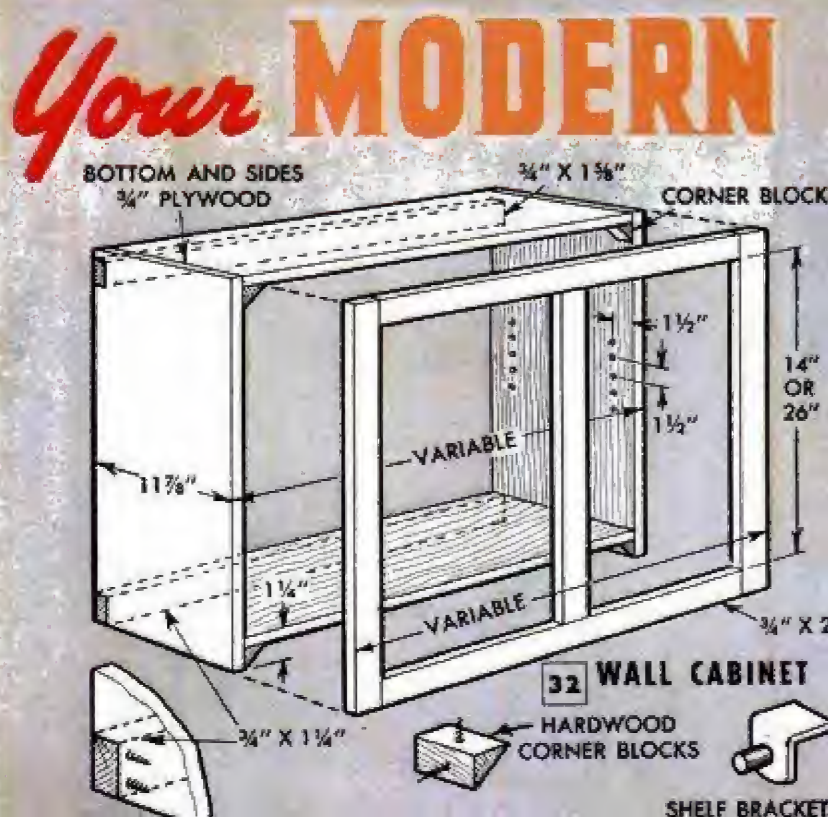
Twin-blade, rotary mower converts quickly to power snowplow to give year-round duty. Construction story on page 199 presents complete details for building it yourself

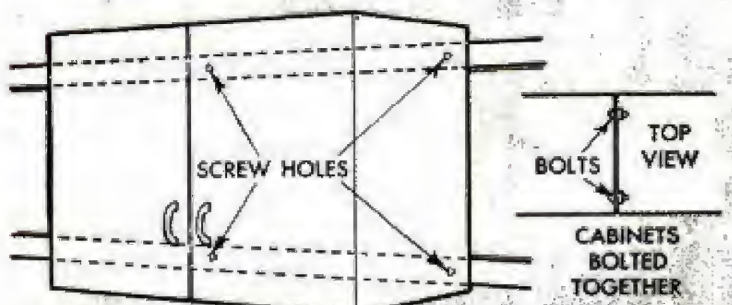
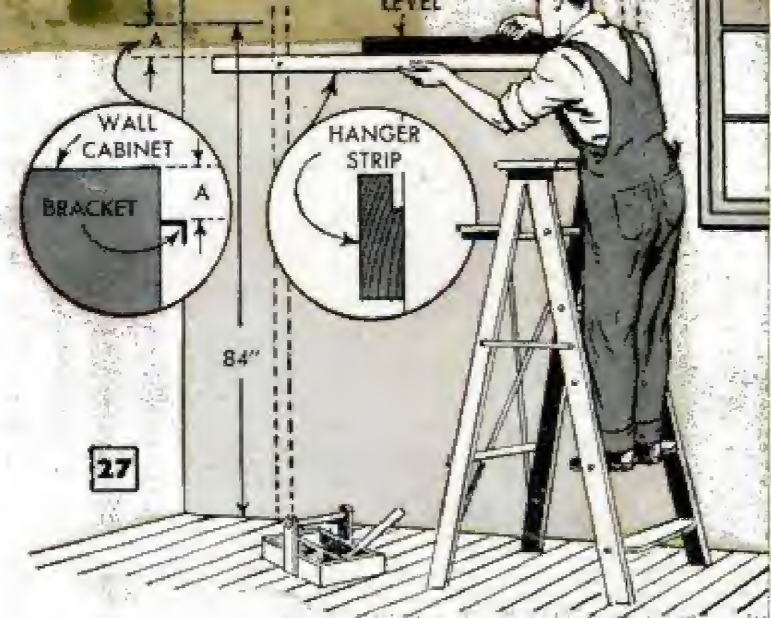


General Electric Co. photo

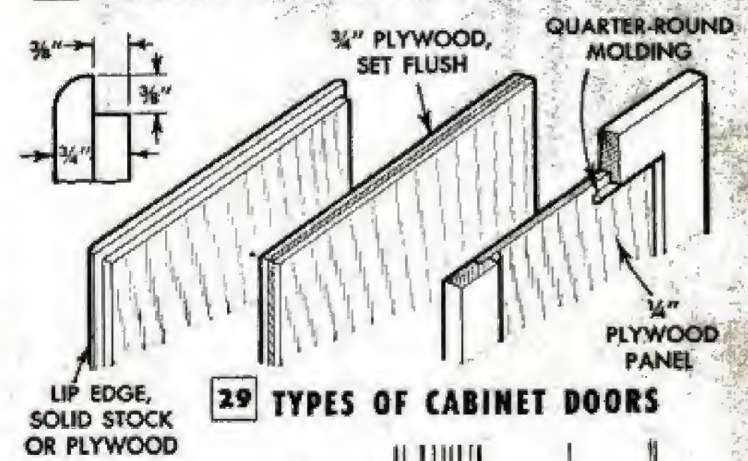
Building your own cabinets and special built-in fixtures

JUST AS in any home-remodeling job, a major saving in the cost of converting your present kitchen into a modern, streamlined one can be had if you are able to pitch in and do most of the work yourself. This is especially so when it comes to making the cabinets, the built-in fixtures and other labor-saving features. Even though these are fairly simple to build, having them made up special at a mill is expensive and sends your remodeling bill soaring. However, the home craftsman with a basement workshop, or, for that matter, any homeowner with hand tools, can turn cabinetmaker and do the work at half the cost. If metal cabinets are





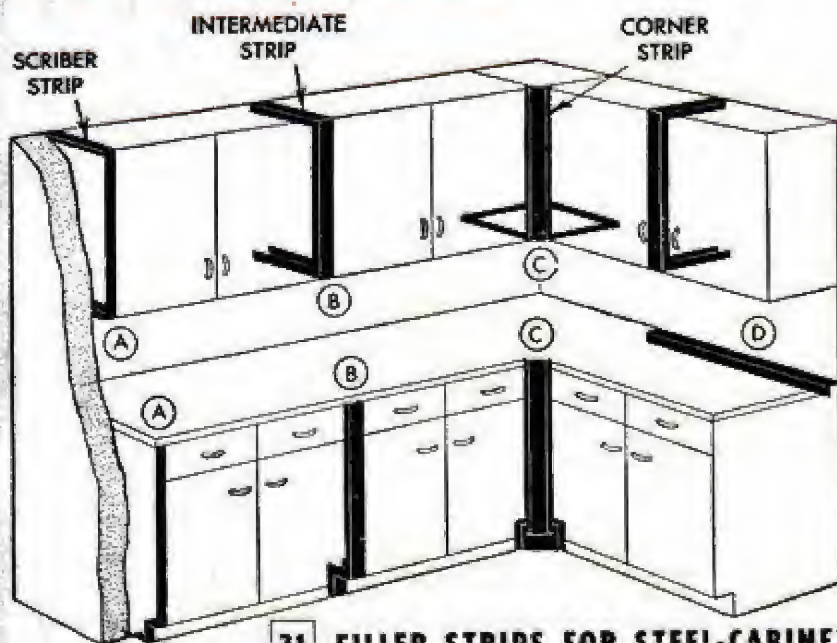
28 CABINETS SCREWED TO HANGER STRIPS



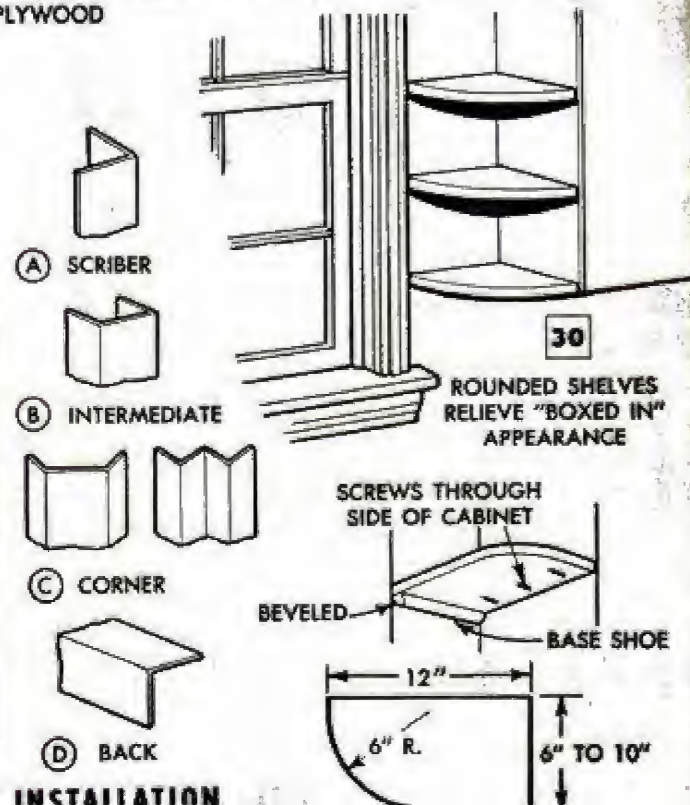
29 TYPES OF CABINET DOORS

KITCHEN

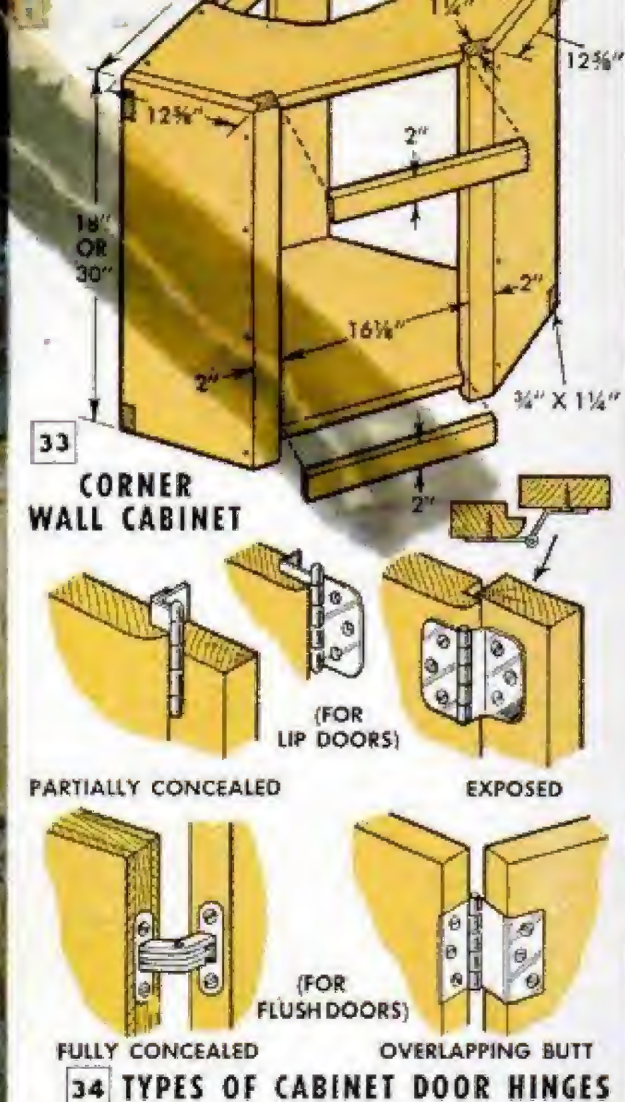
PART II
By E. R. HAAN



31 FULLER STRIPS FOR STEEL CABINET INSTALLATION



30

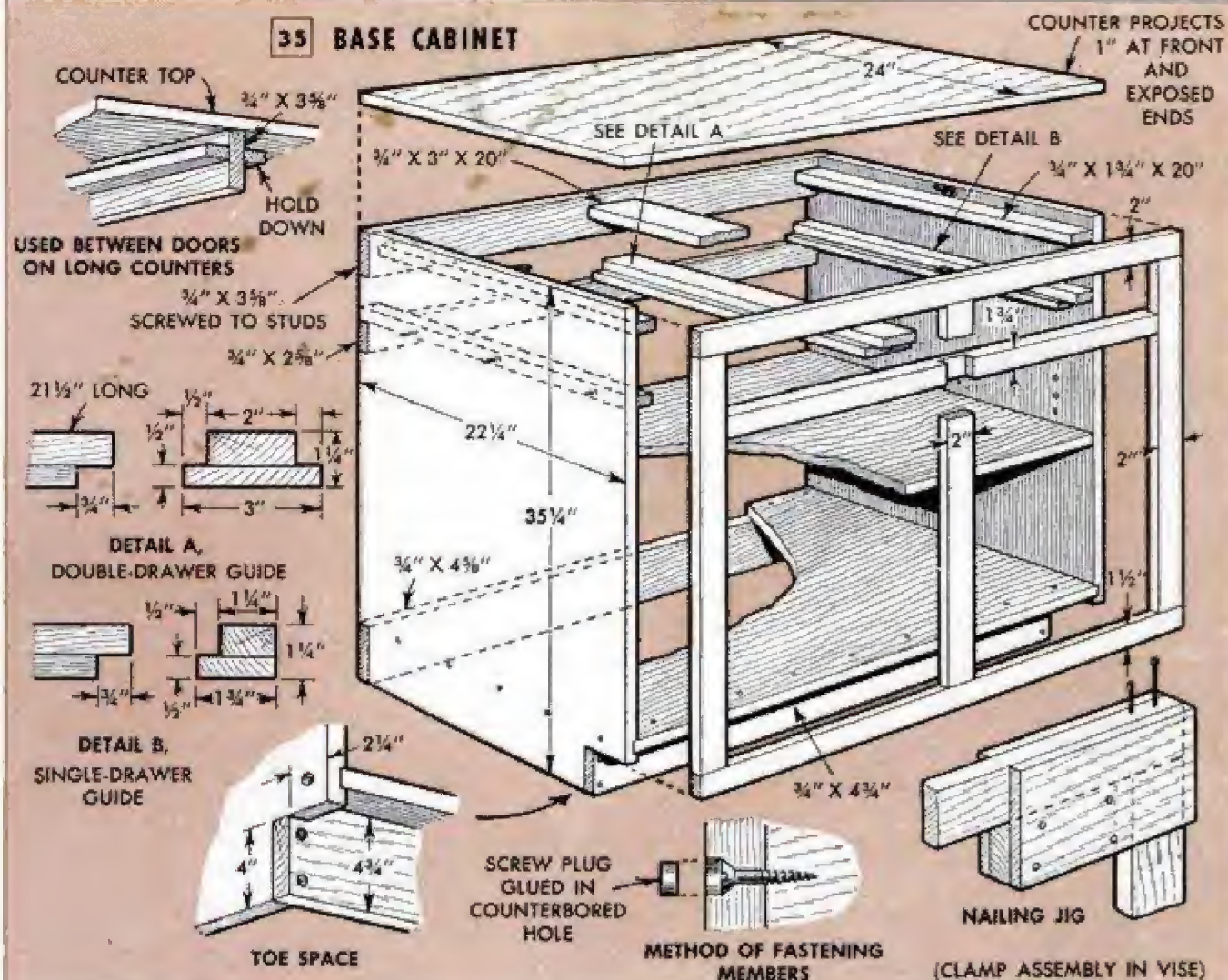


preferred, there's money to be saved by hanging them yourself and, for the man who doesn't want to build from scratch, there are ready-made units and kits on the market which can be assembled right on the job at a considerable saving. This, the second in a series of three articles, treats cabinet construction in detail, including the hanging of both metal and wooden units.

Installing wall cabinets: Before purchasing ready-made cabinets, have a dealer go over your plans and check all dimensions so that the units will fit properly. You can purchase "packaged" units from dealers or mail-order houses and installation instructions generally are provided. Wall cabinets of the standard 30-in. height usually are hung so their tops will come 84 in. above the floor. Most steel cabinets are attached



35 BASE CABINET



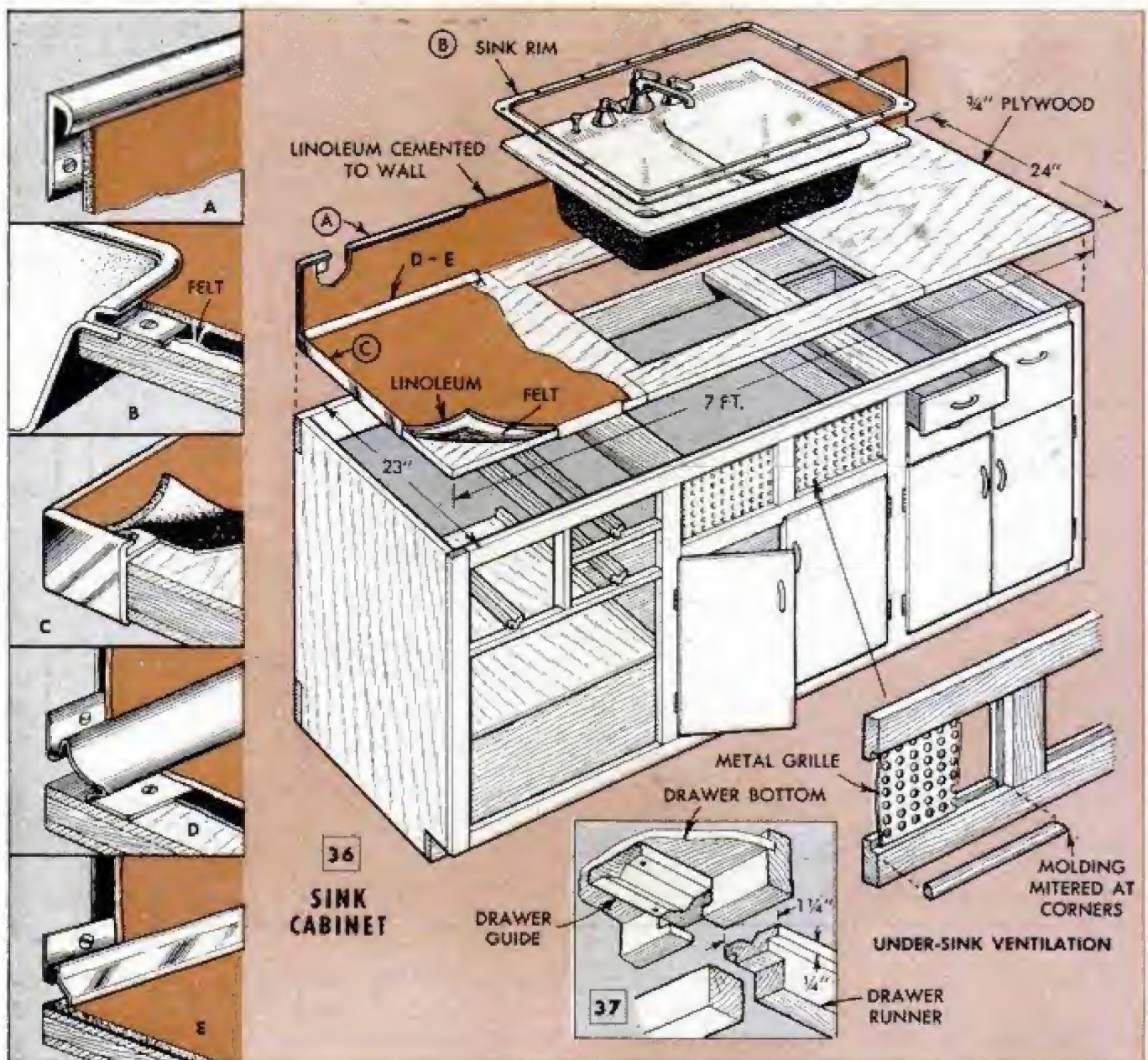
to wooden or metal hanger strips which are fastened horizontally and nailed or screwed into wall studs. The hanger strips, particularly the upper one if two are used, must be absolutely level, Fig. 27. In some cases, hanger strips are used individually on the cabinets; in other cases they extend, as in Fig. 28, to hold more than one cabinet. In still other installations, the cabinets are screwed directly to the walls with the screws driven into studs. On hollow tile walls, toggle bolts are used for fastening, whereas brick walls require screws and expansion sleeves.

When hanging metal wall cabinets, and also when installing base cabinets, the usual procedure is to start from a corner. If your installation does not include corner cabinets having 45-deg. doors, fasten two standard straight cabinets to a metal "corner" filler strip, Fig. 31, C, and to a corner bottom plate. Next, bolt several cabinets together before screwing them to hanger strips or wall. Steel cabinets are sometimes provided with removable knockouts for bolts used to fasten the cabinets together. If not, holes must be drilled. Wooden cabinets generally are fastened together with screws. Before screwing the cabinets permanently, check with a level to see that the

front and sides are plumb. Often it is necessary to use shims behind the cabinets where plastered walls are uneven.

Avoid locating a refrigerator next to a corner wall cabinet as it will interfere with opening the cabinet door. Avoid having a cabinet butt tightly against an end wall, as this would interfere with the operation of doors. This also applies to base cabinets. The needed clearance space between cabinet and wall is concealed by using a "scriber" filler strip, Fig. 31, A. If the wall is uneven, the strip is held in position, scribed to conform to the wall surface and then cut accordingly with tin shears and fastened in place. On metal wall cabinets having sides that do not conceal the hanger strips, "back" filler strips, Fig. 31, D, are added for concealment. A spacing of 6 to 10 in. is recommended between wall cabinets and windows where rounded shelves, Fig. 30, are used. When it is necessary to fill a gap of a few inches between cabinets to stretch them, an "intermediate" filler strip, Fig. 31, B, is used. These strips come in various widths.

Base cabinets and counters: Installation of base cabinets is started at corners the same as with wall cabinets. If the corner space is not to be used, two straight-type



cabinets can be butted together at right angles and a corner filler strip added at the front. Then a counter support cleat is nailed or screwed to the wall studs. Corner space can be utilized with special cabinets having parallel-to-wall or 45-deg. fronts, in which case no corner strips are needed. The cabinets are fastened together, shimmed with wooden wedges to get them perfectly level on uneven floors, then screwed to wall studs. A base shoe will hide the exposed crack where the cabinet is raised above the floor.

A base-cabinet assembly also can be "stretched" to desired length by either inserting a narrow tray cabinet or else using one or more "intermediate" filler strips between the cabinets. A single counter can extend over the entire assembly although, in some packaged units, individual cabinet counters are provided. Where counters butt against sinks, wedge-shaped filler strips coated with sealing compound assure waterproof joints. Backsplash on sinks and counters may be integral with them, may be attached as separate units, or may be

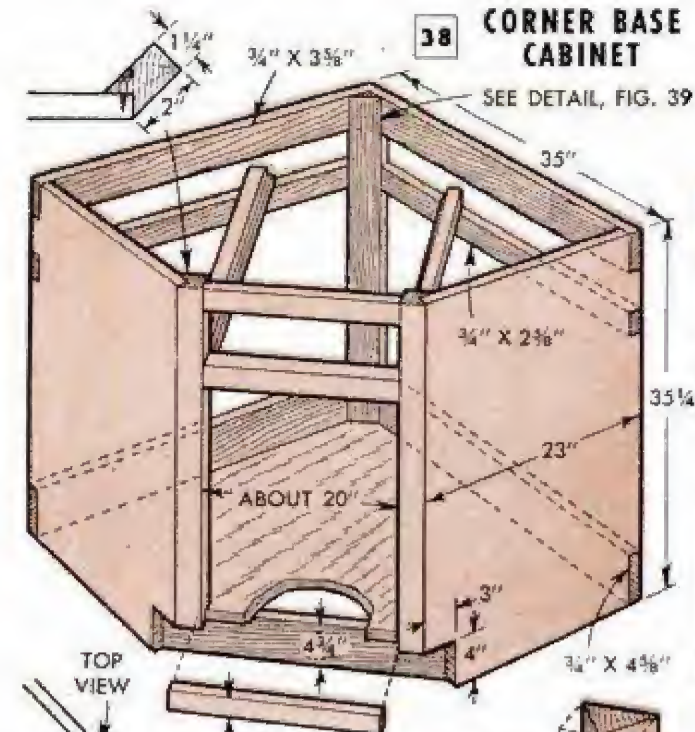
provided by covering wall with linoleum.

Building your own: Cabinet construction is simplest if $\frac{3}{4}$ -in., 7-ply plywood is used together with solid stock lumber. White pine is good, and so is birch or gum. Thin plywood or hardboard requires additional framework and entails considerable joinery. Simple screwed or nailed joints, coated with glue where possible, give adequate strength, although dowels produce stronger joints where narrow stock is butted together. Flat-headed screws are concealed in holes counterbored and drilled for the screw body. A pilot hole should be drilled for the thread portion of the screw, and the screw coated with soap for easy driving. Plugs, cut from dowels that fit the holes tightly, are glue-coated and driven to come flush with the surface. Crack filling, sanding and painting will conceal them entirely.

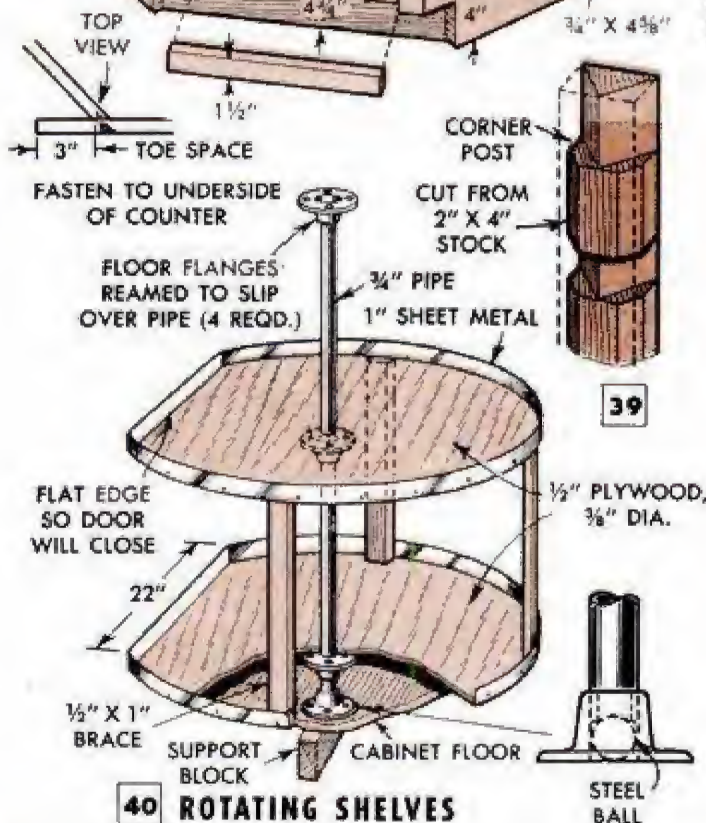
Making wall cabinets: The top, bottom and sides of wall cabinets, Fig. 32, are $11\frac{7}{8}$ in. wide to get four widths, including waste for saw cuts, out of a standard 48-in. plywood panel. Before assembling, the inner faces of the side members are drilled for

CORNER BASE CABINET

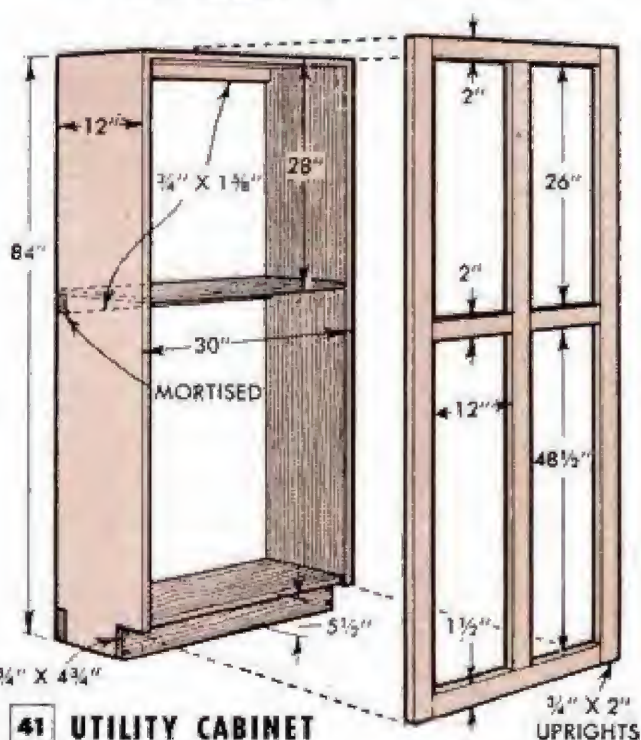
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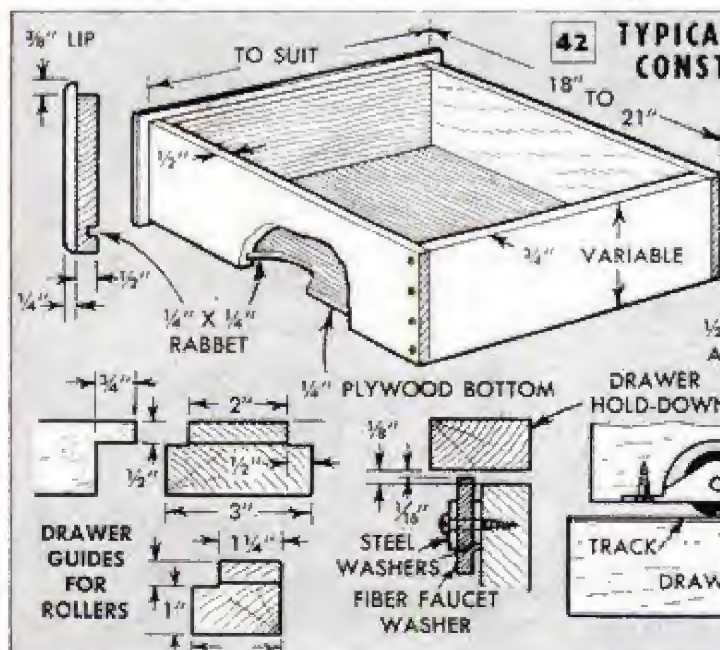
SEE DETAIL, FIG. 39



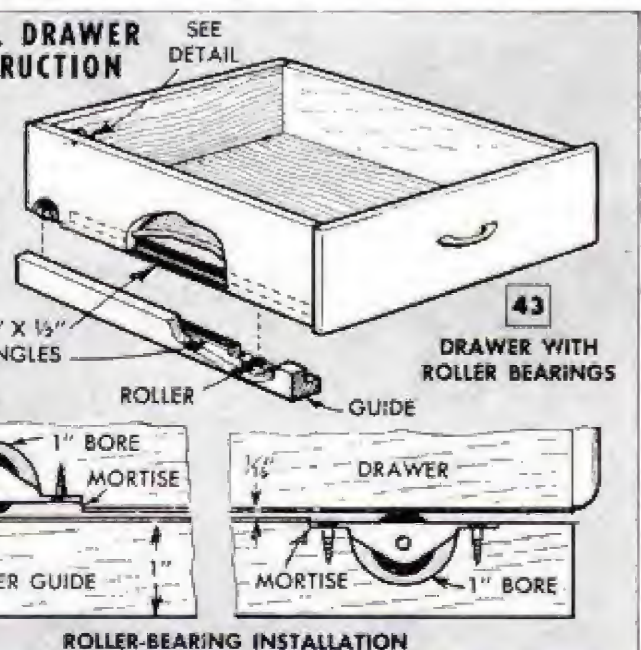
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41 UTILITY CABINET



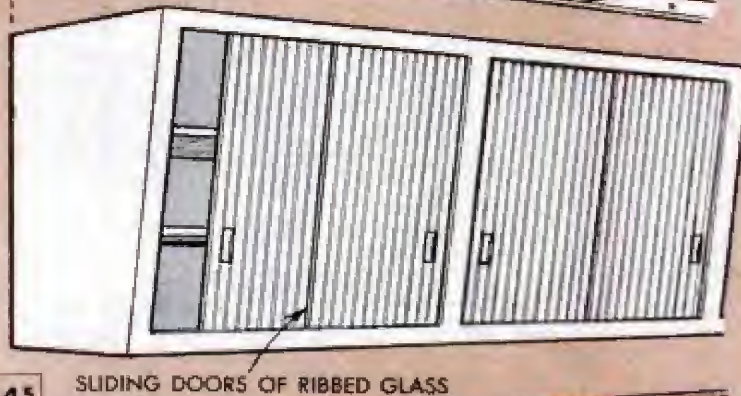
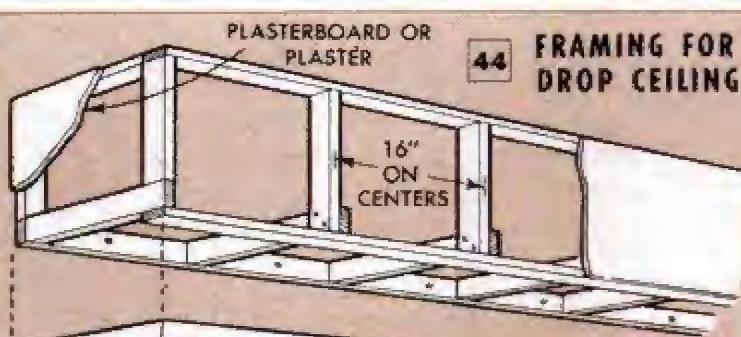
42 TYPICAL DRAWER CONSTRUCTION



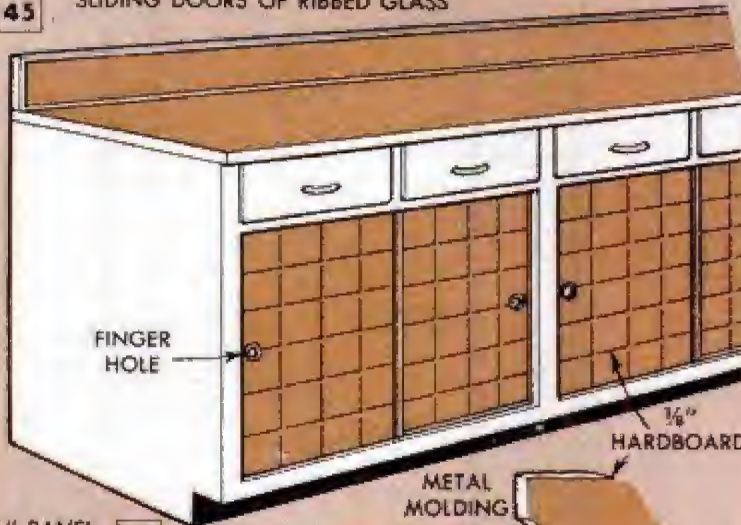
43

DRAWER WITH ROLLER BEARINGS

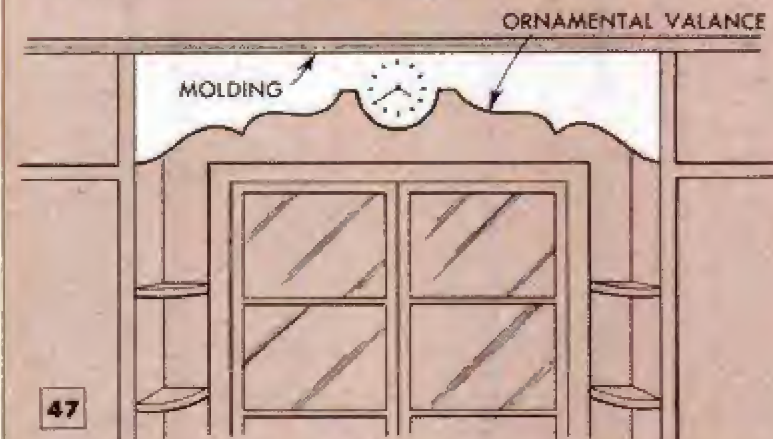
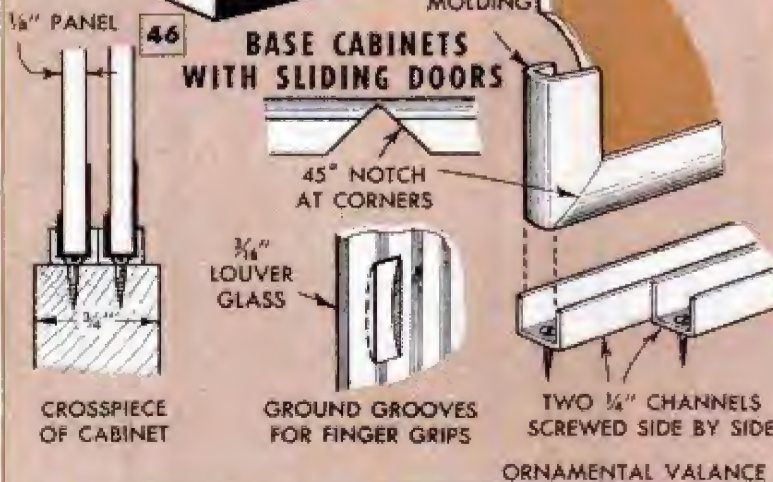
ROLLER-BEARING INSTALLATION



45 SLIDING DOORS OF RIBBED GLASS



46 BASE CABINETS WITH SLIDING DOORS



47 VALANCE USED WHEN CABINETS EXTEND TO CEILING

shelf brackets. Note that the front framework is made separately of solid stock and fastened with glue and 6 or 7d finishing nails. Butt joints of narrow stock can be assembled flush at the sides with the nailing jig shown in Fig. 35, using a C-clamp to hold the joining pieces together tightly. Then two 10d finishing nails are driven in, slightly toed toward each other, and the heads are sunk about $\frac{1}{2}$ in. deep with a nail set. For extra rigidity, hardwood corner blocks are glued and screwed in place. When cabinets extend to the ceiling, the portion above the 84-in. height should have separate doors.

In the corner wall cabinet shown in Fig. 33, the sidepieces of the doorframe are hardwood, rabbeted, glued and screwed to the side panels. Corner posts for wall and base cabinets are made as shown in Fig. 39. Top and bottom of the cabinet extend 1 in. into the doorframe so that $\frac{3}{4}$ -in. inserts will fit flush with the front.

Rounded shelves to flank windows are detailed in Fig. 30. Three types of modern cabinet doors are shown in Fig. 29 and five types of hinges are shown in Fig. 34. In fitting the doors, allow $\frac{1}{16}$ in. all around the opening for clearance.

Construction of base cabinets: Baseboards are removed for installing base cabinets detailed in Figs. 35 and 38. Toe space should be 4 in. high and 3 in. deep. If desired, the cabinet floor may be set into $\frac{1}{8}$ -in. grooves in the sides for added rigidity, the floor being glued and screwed through the sides. As with wall cabinets, the front framework is made separately and, after it is attached, the drawer guides, hold-downs and counter-support crosspieces are installed. An alternate arrangement for drawer guides, using a single V-shaped guide for each drawer, is shown in Fig. 37. For ventilation under a sink, metal grilles are advised, and counters can be screwed to base units with angle brackets.

As corner base cabinets, Fig. 38, are too large to pass through doors, they must be assembled in the kitchen. Note that the door-frame is similar in construction to that of the corner wall cabinet. Rotating-shelf units, called Lazy

Susans, Fig. 40, are laborsavers. Floor flanges, reamed out to slip over $\frac{3}{4}$ -in. pipe, serve as bearings and the weight is carried by a steel ball in the lower flange. Three or four braces between the shelves and a block under the cabinet floor are required.

Drawer construction is shown in Fig. 42. A clearance of $\frac{1}{16}$ in. should be allowed at the top, bottom and each side of a drawer to avoid binding in the frame and guides. Utility cabinets usually extend to the top of wall cabinets. Fig. 41 gives construction.

Roller drawer bearings: If you want easy-action drawers at moderate extra cost, install rollers and tracks as shown in Fig. 43. A roller is recessed in each side of a drawer at the back and another roller is recessed in the front end of each guide. The guides must be hardwood and at least $1\frac{1}{2}$ in. thick. A metal track of $\frac{1}{2}$ -in. angle is screwed to each side of the drawer and to each guide. The rollers project slightly beyond the track surfaces to prevent the tracks from rubbing against each other. Fiber washers, arranged to rotate on screws, minimize friction against the hold-downs.

Counter covering: Linoleum is widely used for counter tops, although plastics and tile have been found suitable. Linoleum is laid over felt, Fig. 36, both being cemented with moisture-repellent cement. There are many varieties of linoleum edging in anodized aluminum, stainless steel and plastics. Details A to E, Fig. 36, show the various types which are used.

Sliding cabinet doors: To make sliding doors of $\frac{1}{8}$ -in. tile-effect hardboard, cement them in stainless-steel linoleum edging, Fig. 46. By making 45-deg. cutouts, the edging can be brought around corners neatly. The doors slide in metal channels screwed side by side, while bezels frame finger-grip holes.

Sliding doors of $\frac{3}{16}$ -in. "louver" glass are attractive for wall cabinets, Fig. 45. A $\frac{3}{16}$ -in. channel is cemented to top and bottom edges of the glass. The side edges of the glass are smoothed with emery cloth and the doors slide in $\frac{3}{8}$ -in. channels. Shallow grooves are ground for finger grips.

Valances and drop ceilings: When cabinets extend to a ceiling on either side of a window, a valance, Fig. 47, greatly improves the appearance. A drop ceiling or soffit, to close waste space over wall cabinets, should be installed before they are mounted. A sturdy framework, Fig. 44, is attached to ceiling joists and wall studs. Front and bottom are covered with plaster-board and plaster, not extending beyond the front edge of the wall cabinets. The plaster should be bonded to the ceiling plaster after chiseling off some of the latter alongside the joint to prevent a crack.

(To be continued)

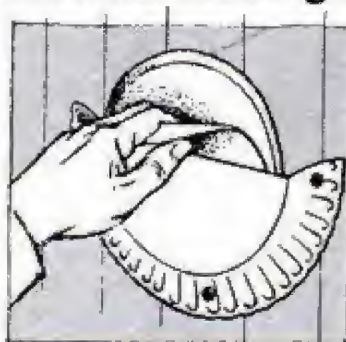


Motor-Oil Cans Form Parts Rack

This novel small-parts rack made from motor-oil cans holds a quantity of nails and screws in individual containers for easy selection. The cans, from which the tops have been removed, are set on a board nailed to the shop wall. The board is nailed at a slight angle to tilt the cans upward, and the oil remaining in the cans helps to keep the contents from rusting.

Harry W. Strand, Evanston, Ill.

Paper Plate Tacked to Shop Wall Provides Sanding-Disk Holder

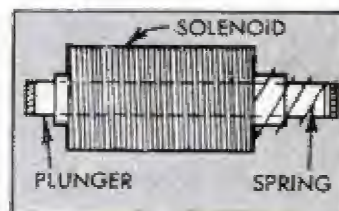


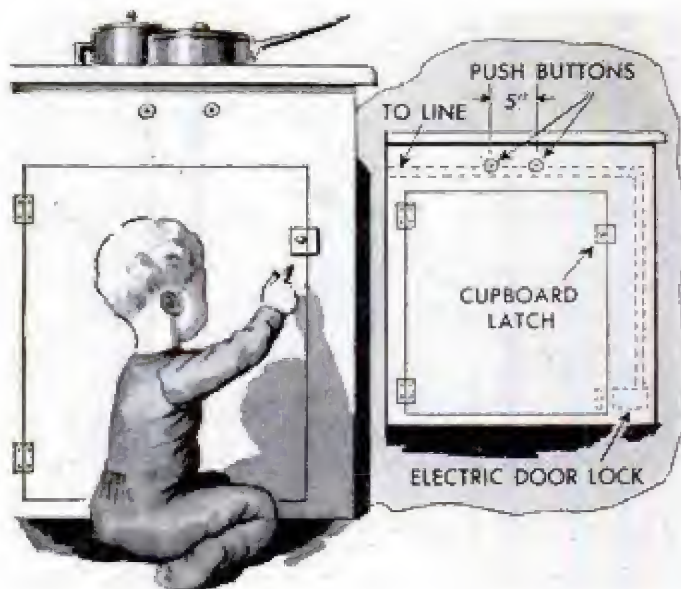
Utilizing a holder improvised from a paper plate, a number of sanding disks can be stored at your finger tips. Cut the plate in half and mount one of the halves on the shop wall near the sander.

Use thumbtacks to tack the rim to the wall so the dished portion of the plate will serve as a pocket. The holder is replaced easily when it becomes worn.

Polishing Door-Chime Plunger Increases Volume

Finding that my door chimes were not loud enough to be heard in every room of the house while the radio was playing, I increased their volume by polishing the plunger. I removed the plunger, buffed it to a mirrorlike finish and then replaced it in the solenoid. This reduced friction to the point where the plunger now travels extremely fast, thus striking the chimes with greater force.—Jules Rafalow, New York City.



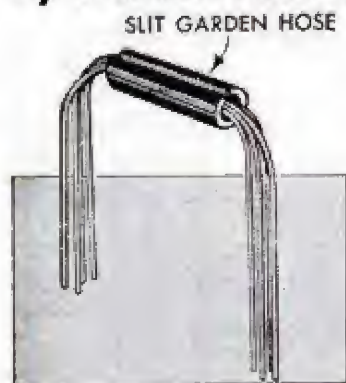


"Baby Proof" Lock for Cabinet Safeguards Inquisitive Child

One of the most distressing problems of parents who have a curious toddler investigating every nook and cranny in the house is that he might sample bleach, lye or some other poisonous cleaning solution. To set his mind at ease, one parent installed a "baby proof" lock on the door of the storage cabinet in which cleaning materials are kept. In addition to the regular cupboard latch, he fitted an electric lock on the cabinet door, using a standard electric door lock. Two push buttons, wired in series, must be depressed simultaneously to open the lock, and these are spaced 5 in. apart—too far for the spread of the tiny fingers of a baby's hand. If the child uses both hands to depress the push buttons, the cupboard latch still keeps the door closed. An adult can depress both buttons with one hand while opening the latch with the other.

A. J. Seymour, Jr., Salmon Falls, N. H.

Storing Croquet Wickets Facilitated By Garden-Hose Section



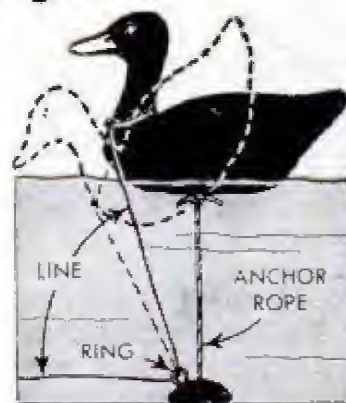
Croquet wickets are stored with less danger of loss if they are held together with a short length of garden hose. The hose is slit lengthwise and, as the wickets are collected after a game, the top portion of each

wire is pressed into the slit. Because of the bends in the wires, the wickets cannot slip from the ends of the hose.

Colored fingernail polish can be used to paint wooden buttons to suit any costume.

Duck Decoy Controlled From Blind Looks Like Feeding Bird

As ducks which are apparently feeding undisturbed will attract immediate attention from incoming flocks, rig up the two decoys nearest the blind so they can be made to dive and dip realistically to simulate feeding. To do



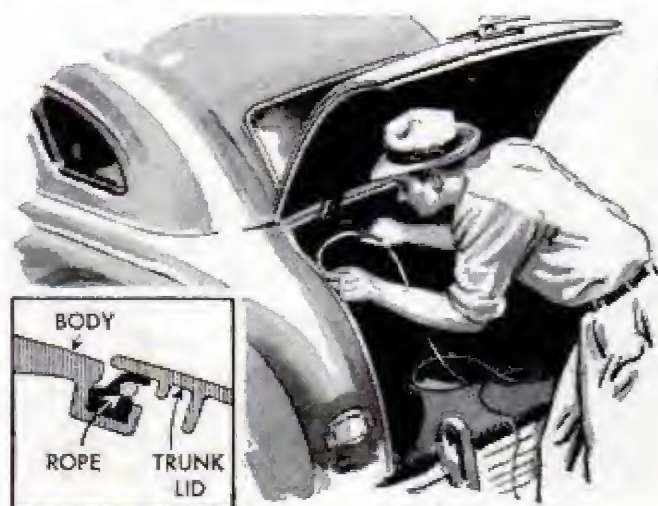
this, fasten a long, strong cord to the neck of each of the two decoys. Run the cord through a ring or screw eye attached to the decoy anchor, and then bring the end of the cord into the blind. When a flock of ducks is sighted, draw them closer with the feeding call on your duck caller and simultaneously pull the lines leading to the decoys. Attracted by the motion of the decoys, the flying flock will circle and come in.—R. A. Jenkins, St. Louis, Mo.

Dusting With Pigment Colors Putty

A quick way to paint putty is to dust a little lampblack or other dry color over the surface of the putty before the putty has had time to harden. The pigment will absorb enough oil from the putty to form a glaze over the surface.

Rope Expands Car-Trunk Gasket To Renew Watertight Seal

In some older cars, trouble with leaking trunk-compartment gaskets can be corrected in a jiffy by inserting a length of small-diameter rope or cord between the fold of the rubber gasket. Braided cotton cord of the type used as pull cords on Venetian blinds usually will expand the gasket sufficiently to provide a watertight seal between the car body and trunk door.





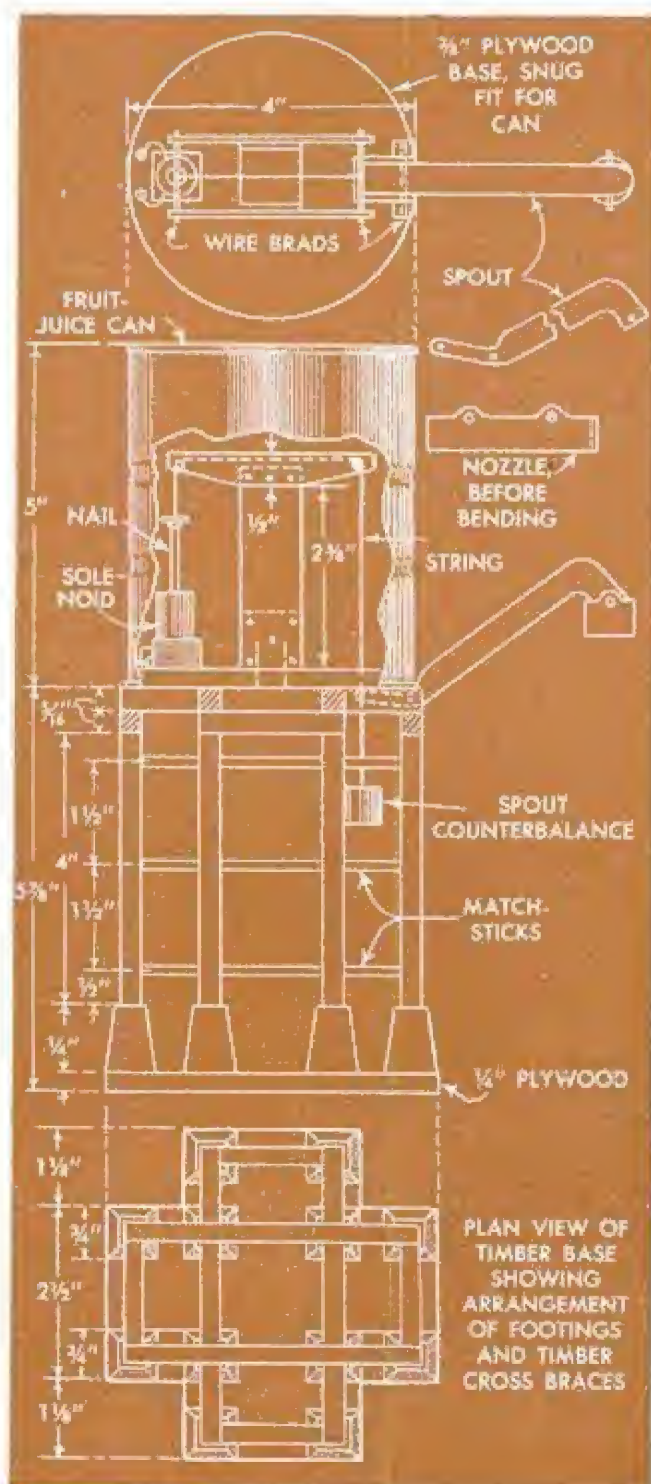
MODEL-RAILROAD WATER TANK

By Webster P. Taylor

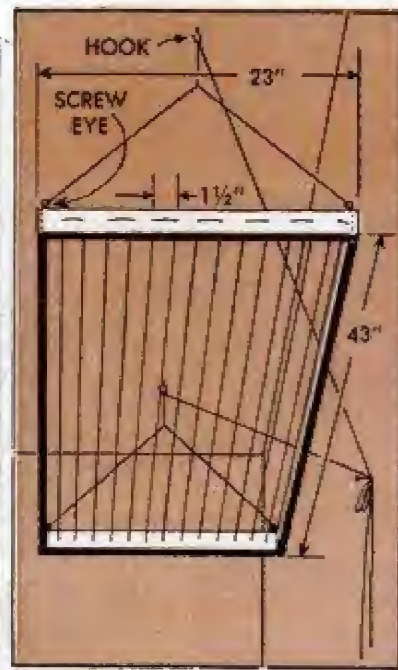
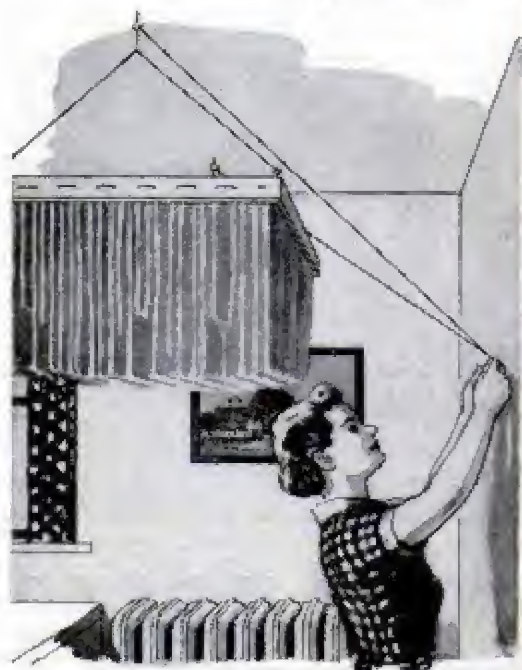
AS A FAST FREIGHT grinds to a stop at the station, the push of a button lowers the nozzle of this realistic water tank. When the button is released, the counterbalanced spout is raised automatically. The dimensions are easily altered to suit your particular setup, and the length of the spout is governed by the size of the train.

The dummy tank is a fruit-juice can supported by a timber framework. The timbers are glued to wooden footings mounted on a plywood base. Ripped from scrap stock, the timbers are drilled for matchstick cross braces which are glued in place when the framework is assembled.

The wooden spout is fitted with a sheet-metal nozzle and pivoted to the timber framework. The spout is counterbalanced to return it to the raised position, the edge of the can being notched if necessary to provide clearance. The weight is suspended from one end of a length of string, and a nail, which enters a solenoid, is suspended from the other end. The string is tied to the spout arm and passed over two brads which are supported by wooden crosspieces nailed to a center upright. The solenoid consists of a coil of No. 22 cotton-covered wire wound between two faucet washers on a 1-in. length of $\frac{1}{4}$ -in. dowel. The coil is mounted on a wooden block, and both dowel and block are drilled lengthwise to receive the shank of the nail. When current passes through the solenoid, the nail is drawn downward, thus pulling on the string and lowering the spout. The position of the nail must be determined by experiment.



Indoor Drying Rack for Baby Clothes Suspended Over Heater or Register



If there is no room to hang the baby's clothing and diapers indoors, the things can be dried quickly during cold weather by using this compact rack, which is suspended from the ceiling near the source of heat. The wooden frame is strung with 100 ft. of clothesline, and lines for raising or lowering the rack are tied to screw eyes turned into the four corners. The lines are then passed over screw hooks driven into the ceiling joists. When the rack is raised, the lines are made fast to a hook which is fastened to a near-by wall.—Bob Pilkington, Grinnell, Iowa.

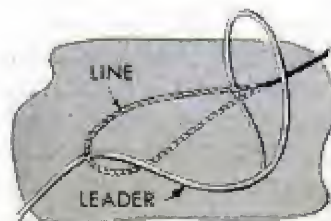
Soldering Iron Polishes Leather to Obtain Smooth Edges

Craftsmen who work in leather frequently find it difficult to obtain a smooth, clean edge when finishing the project. This can be done easily by first shaping the edge as carefully as possible with a knife and then heat-polishing it with a soldering iron. Using a small iron, heat it to the point where it will melt solder. Then run the iron along the edge of the leather, keeping it moving with a light pressure on the work.

After the entire edge has been treated with the soldering iron, it should be rubbed briskly with a coarse cloth to remove any charred particles. This will result in a fine edge which, after the application of a little saddle soap, will look like a professional job. When using the soldering iron, be especially careful not to burn the leather, as this will detract from the appearance of the work.—John M. Avery, Dexter, N.Y.

Loop Tied at End of Fishline Facilitates Attaching Leader

Attaching a leader to a fishline is done in a jiffy and there's no chance of its slipping off, if a permanent loop is made at the end of the line. To form the loop, bring the end of the line back against itself and



whip the two strands together with light sewing thread. Then seal the joint with clear fingernail polish. The leader is attached by passing the loop of the

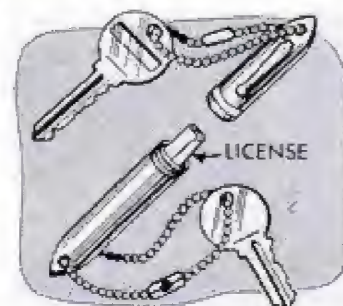
leader over the end of the line and bringing the other end of the leader through the loop in the line as shown in the drawing.

Robert K. Ungemah, White Plains, N.Y.

☐ Curled rug corners can be straightened by dampening them with water and weighting with a heavy object until dry. Place cloths or newspapers under the rug to protect the floor from the moisture.

Convenient Key and License Holder From Small Fountain Pen

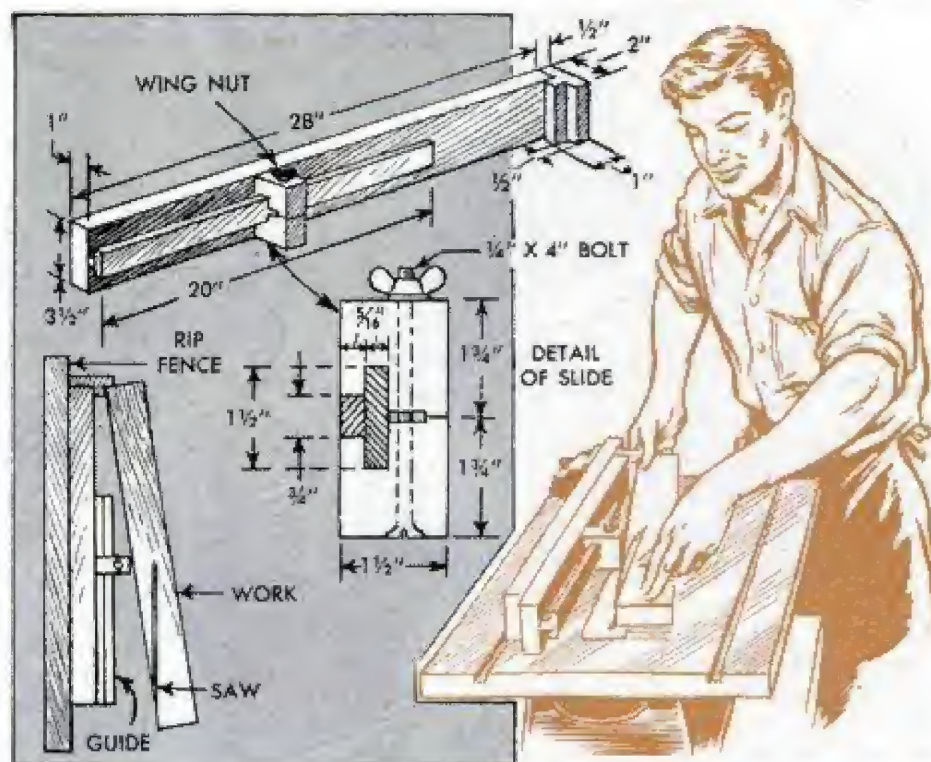
When, after starting the car, you remember something that was left in the house, it means turning off the ignition if both car and house keys are kept on an ordinary ring. However, if a discarded short-barreled fountain pen is used to form a



two-piece key holder, the portion from which the house keys are hung is unfastened from the other part of the pen, and the motor can be left running while you go back into the house. In addition, the pen provides a container for your auto identification. To adapt the pen for a key holder, remove the point and sack from the barrel and drill holes for key chains through the barrel and the cap. Then string the house keys on one chain and the car keys on the other.—Richard Theis, Tiffin, Ohio.

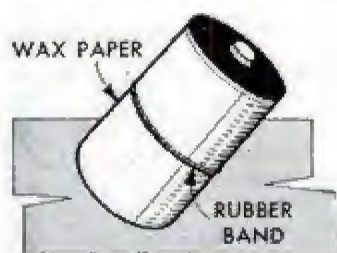
VARIABLE TAPER-CUTTING JIG FOR BENCH SAW

Especially handy for cutting long tapers when building furniture, this hardwood jig allows the work to be cut at a wide variety of angles. One corner of the work is placed against the end block of the jig and the edge of the work is held against a movable slide, the location of which determines the angle of cut. Then the jig is pushed along the rip fence. Note that the movable slide is clamped to the guide strip with a bolt and wing nut, and that the end block has two steps to permit increasing the range of cutting angles.—L. F. Stephan, Homestead, Pa.



Emergency Service From "Dead" Flashlight Battery

If the battery of your flashlight wears out and you cannot get to a store to buy new cells, here's how you can obtain another eight or ten hours of emergency use from the "dead" cells. If there is not a corrosion hole in the side of the cell jacket, punch a small hole through the casing with an ice pick or knife. Then soak the cells in water or vinegar for about an hour. After removing the cells from the



bath, dry them and wrap wax paper tightly around each one, fastening it in place with a rubber band. Simply replace the cells in the flashlight case in the usual way.

Jack Casper, Brooklyn, N.Y.

Glove Finger Tips Mended Quickly

Mending the finger tips of woolen or fabric gloves can be done quickly by slipping a glass or plastic toothbrush container into the tips of the finger to be repaired. When mending dark-colored gloves, stuff white tissue paper in the end of the container so the thread will be clearly visible.

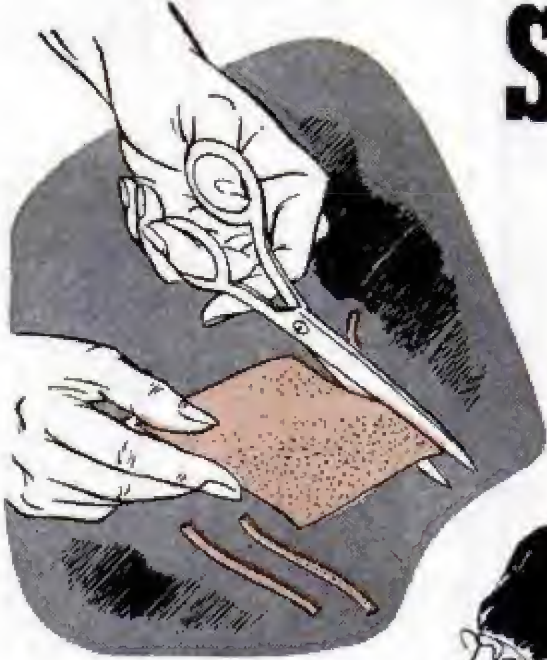
Mirror Mounted on Garage Door Affords View of Driveway

To make sure that neither the children nor their toys were in the driveway when backing his car out of the garage, one homeowner fastened a mirror to the inside of the swinging garage door. The mirror is located so that it gives a clear view of the driveway when the door is fully open, thus overcoming the blind spots in the rear-view mirror of the car. If the garage has an overhead door, a mirror can be mounted on a bracket which is fastened to the inside of the door casing. However, this can be done only if there is enough clearance to allow the car to pass.—Jim Forrest, Winston, Ore.



☞ Boiling new clothespins for 15 minutes before they are used will make them stronger and prolong their life.

Solving HOME



SHARPENING SCISSORS with fine-grade sandpaper is a simple way to keep the cutting edges keen. Merely make several cuts through the paper occasionally, and abrasive action will whet the edges of the scissors blades



YARN REMNANTS ARE STORED safely by wrapping them around ordinary moth balls. The latter will afford maximum protection from moths in addition to providing handy cores around which to wind the remnants



IRONING A CRUMPLED DRESSMAKER'S TAPE between two sheets of wax paper will restore original stiffness to the tape. The heat from the iron melts the wax which is transferred from the paper to the fibers of the tape where it solidifies when cooled

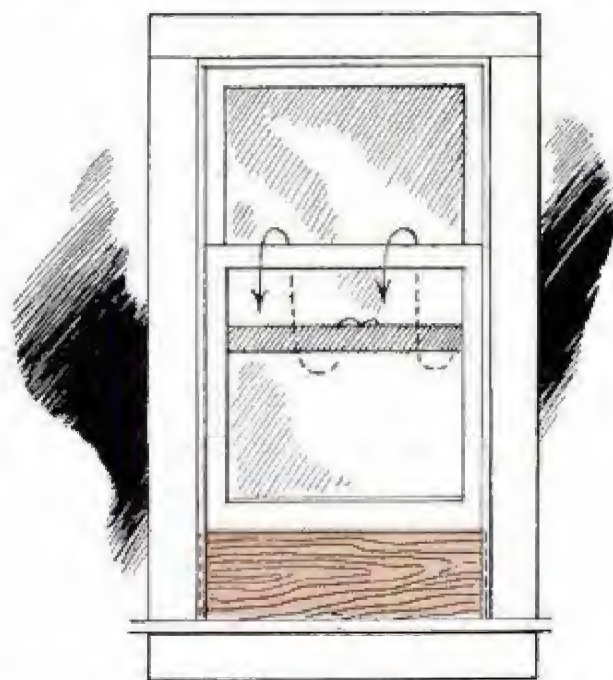


SLIP COVERS WON'T PULL OUT OF SHAPE and present a disheveled appearance if they are held in place with sponge-rubber pads. The pads, which can be cut from a sponge-rubber seat cushion, are wedged between the arms, or back, and seat of the chair after the slip-cover fabric has been pulled taut



LARGER, STURDIER BLOOMS will be had from African violets if the stems of the outer leaves are protected from contact with the rim of the flower-pot. Covering the rim of the pot with decorative aluminum foil will not only protect the stems from damage but also will add to over-all appearance

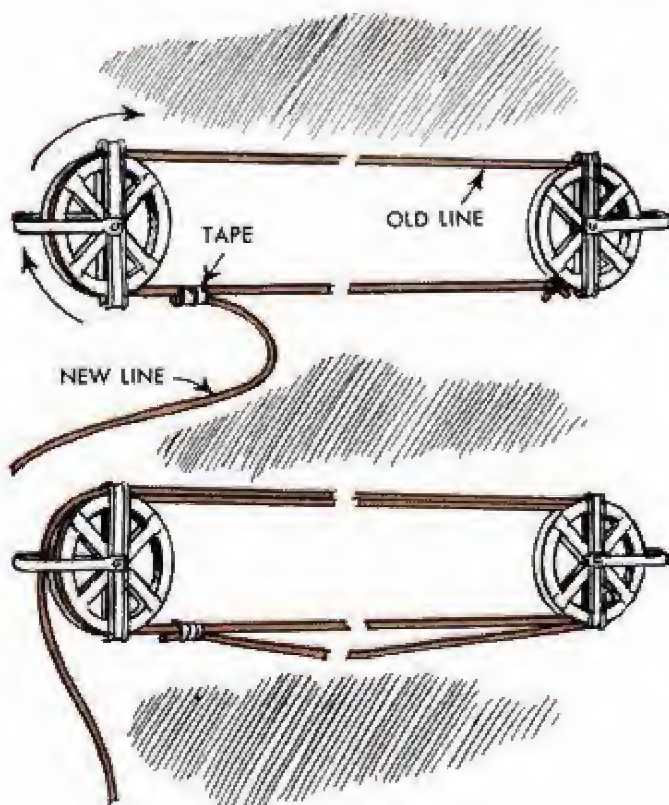
PROBLEMS



KITCHEN VENTILATION without direct drafts can be achieved by opening a lower sash and placing a board under it. The board, which is cut to fit between the sash channels, allows air to enter only through the space between the upper and lower sash



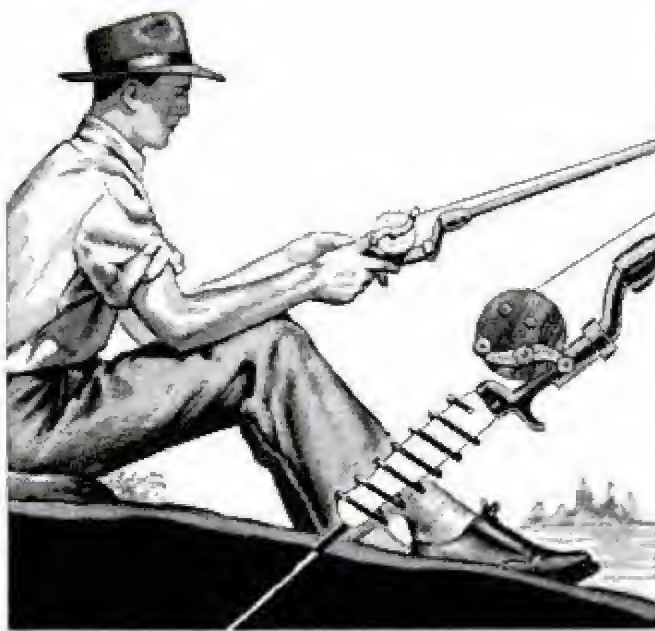
AFTER OILING AN ELECTRIC FAN, slip a large paper sack over the blade guard to catch any excess oil that otherwise would be likely to splatter walls, furniture and draperies. Turn on the fan and allow it to run for a few minutes before removing the sack



WHEN REPLACING CLOTHESLINE on high pulleys, it isn't necessary to climb a ladder if you use the old line to pull the new one in place. Just tape the end of the new line to the old one and pull it around until the ends can be tied. Then cut the old clothesline free



TOOTHPICKS LOCATE NAIL HOLES in newly papered wall, thus eliminating the necessity of drilling additional holes when rehanging pictures. A toothpick driven into each hole so that it projects about $\frac{1}{4}$ in. will puncture the new paper when it is pasted down



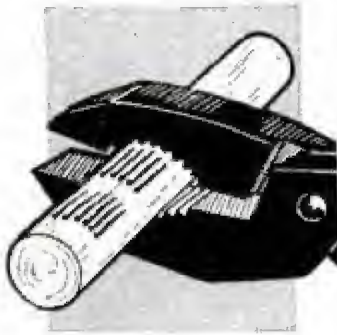
Fish-Pole Holder of Bent Wire Is Set Up Quickly

Anglers who prefer to still-fish from shore will appreciate this wire fish-pole holder which is set up by simply pressing it into the ground. One end of the wire is formed into a spiral slightly larger in diameter and almost as long as the rod handle, and the other end of the holder is left straight. The spiral can be formed around a length of pipe, but it should be remembered that the rod handle must fit loosely enough to permit quick removal from the holder when a fish takes the bait. Although coat-hanger wire can be used for the holder, heavy-gauge steel clothesline wire will give more spring to the rod.

William B. Eagan, Louisville, Ky.

Dowels Indented With Pliers Strengthen Glued Joints

When using dowels and glue to join cabinetwork, the strength of the joint can be increased considerably by indenting the dowel with a pair of pliers. Squeeze the dowel between the jaws of the pliers, as shown, to make indentations all the way around and the full length of the dowel. This will slightly reduce the diameter of the dowel and also provide pockets for the glue.

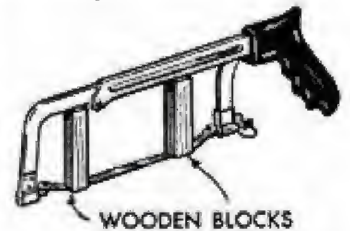


After the dowel is in place, it will have a tendency to expand, thus resulting a tighter and stronger joint.

Wm. A. Novak, Maywood, Calif.

Blocks Lower Hacksaw Blade For Flush Cutting

If it is necessary to cut off a bolt or stud flush with a concrete floor or other surface, the job can be done easily with an ordinary hacksaw. The blade is simply turned at right angles to its normal cutting position and two wooden blocks are wedged between the blade and the saw frame. The blocks should be of a length necessary to bend the blade downward sufficiently to clear the brackets on the frame. With the blocks in place, the saw is held as for vertical sawing with the blade against the surface. Pressure is applied sideways to saw through the bolt.



Hugh Lineback, Stillwater, Okla.

Novel Method Simplifies Making Soldered Connections

With this easy method, even the man who has never handled a soldering iron before can join two wires with a well-soldered connection. After the insulation has been removed, the ends of the wires are twisted together and dipped in flux. Then, the hot soldering iron is touched against the bar or coil of solder, allowing a drop of solder to fall onto a hard, smooth surface. The drop, which flattens out on the surface, is picked up and wrapped around the twisted wires. Finally the tip of the soldering iron is held against the wrapping, thus melting the solder which flows through the strands of wire.

Carter Robertson, Franklin Park, Ill.

☞ A stiff wire brush about 6 in. long is a handy tool for scaling fish.



PINE-NEEDLE BASKETS

By Ed Lundburg

FASHIONING artistic baskets from pine needles and raffia is a hobby that not only affords countless enjoyable hours to young and old alike but results in an item that is readily sold through a variety of home-town outlets. The present popularity of the hobby is due in no small part to such organizations as the Recreation Commission of Long Beach, Calif., which conducts classes in pine-needle basketry. Although this article takes you through the basic steps of making the baskets, you can probably receive first-hand instruction on the more advanced designs from a similar organization in your own community. However, the procedure is not complicated and, after practicing on a few simple baskets, you will no doubt be able to progress without difficulty.

The pine needles, which can be found carpeting the floors of forests in many parts of the country, range in length from 6 in. on up, and a pound or two will be sufficient for a beginner's basket. These are formed in coils and bound with either plain or colored raffia. The most practical type of basket to start with is one having a base cut from $\frac{3}{16}$ -in. plywood, although the more elaborate designs are made entirely of pine needles. After sawing the plywood to the desired disk or oval shape, mark it as shown in Fig. 1, for drilling $\frac{1}{8}$ -in. holes $\frac{1}{2}$ in. apart to permit binding the first coil of pine needles to its edge.

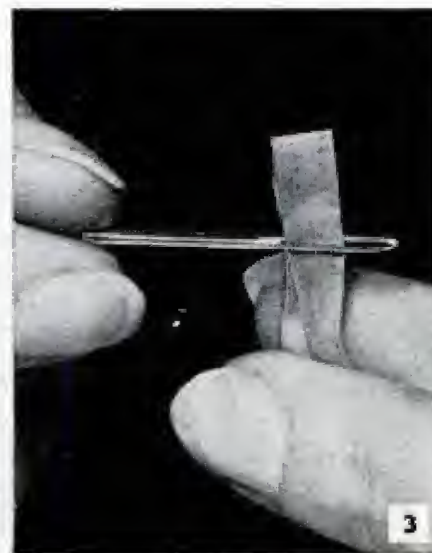
Before beginning the basket, soak the raffia in cool water for 10 minutes, and then

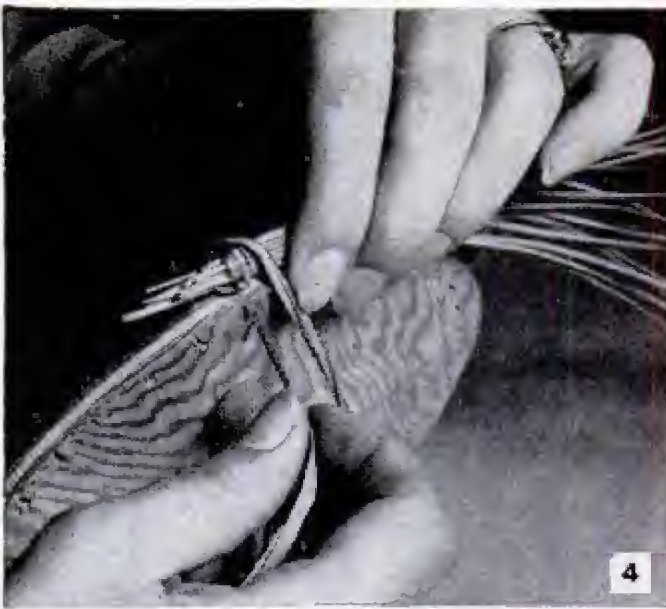


You will be surprised at how easily handsome baskets like these are fashioned from pine needles and raffia

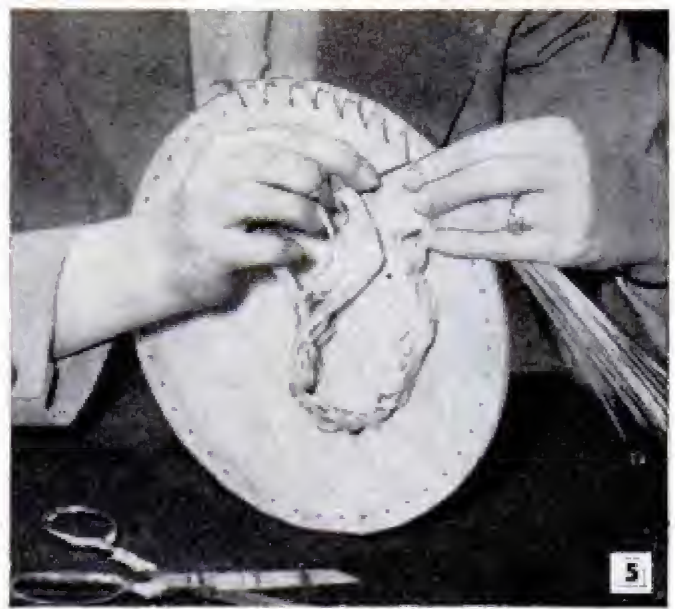
wrap it in a damp cloth to keep it moist. Soak the pine needles in hot water for 20 minutes or in cold water for about an hour and also wrap the needles in a cloth until you are ready to use them. The soaking removes the brittleness from the needles. Note that each cluster of needles has a "boot" covering the base as in Fig. 2. To facilitate splicing the needles in the coil, allow the boot to remain intact until the cluster is to be used.

Splicing the coil is done by adding several needles at a time continually during the progress of the work, Fig. 8. This keeps the coil uniform in thickness and, of course, increases its length. After a No. 16 tapestry needle has been threaded with raffia

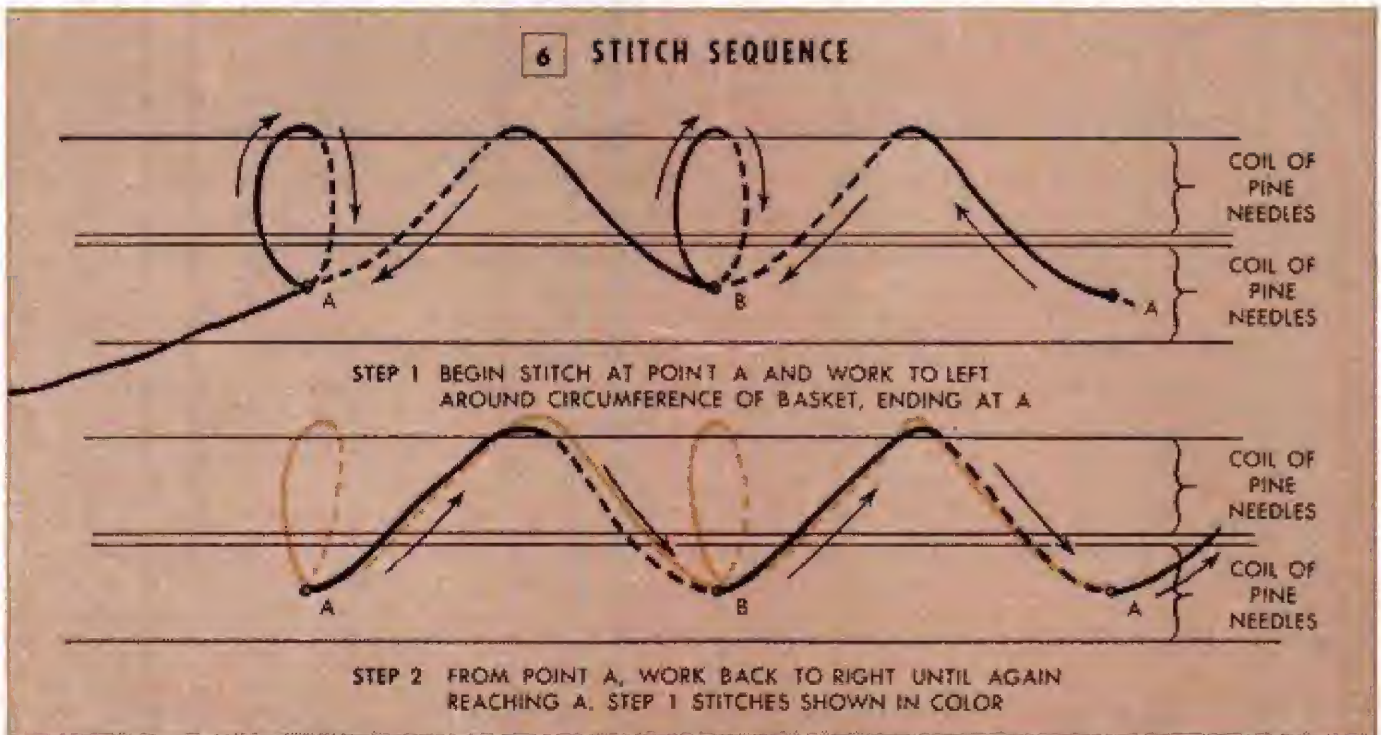




Start the coil of pine needles by binding the end to the plywood base with several wrappings of raffia



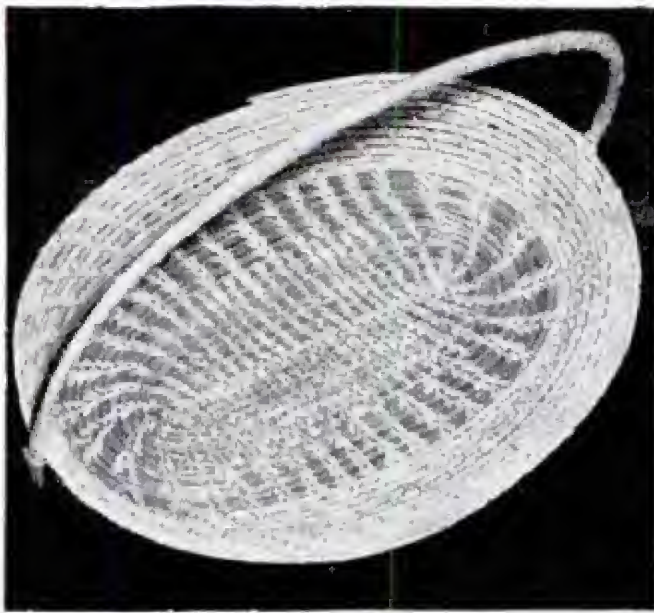
This is how the starting coil will look after a few stitches have been made and before splicing needles



Note how left hand is used to hold raffia taut. Work is done on the side of the basket away from the body

As work progresses, needles are spliced into the coil to keep it uniform in diameter and increase its length





The advanced basket design shown above is made entirely of pine needles instead of having a wooden base. Handy sewing basket is pictured at the right

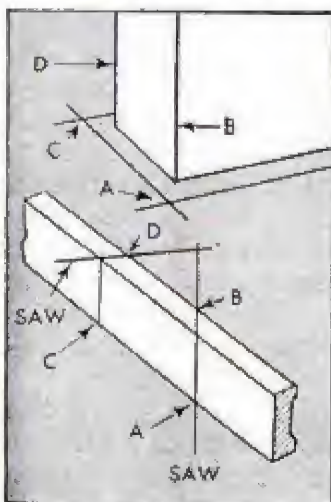


as in Fig. 3, the first coil of needles is bound to the plywood base with a simple over-and-under stitch, Figs. 4 and 5. Subsequent coils are held in place by passing the stitches through the center of the coil below, as in Fig. 7. The stitch sequence is begun as in Fig. 6, step 1, by working to the left from the starting point, A, around the entire circumference of the coil, stitch B, and back to A. Upon reaching point A, work to the right, step 2, adding the slanting stitch until again reaching A. Then proceed to the left on the next coil. Study Fig. 7 which illustrates the technique.

It is recommended that five or six three-pronged pine needles be used to build up the thickness of the coil. However, if a larger coil is desired, remember that a $\frac{1}{2}$ -

in. diameter is considered the maximum for satisfactory results. The basket is completed by tapering the coil of needles and turning the end of the raffia back under the coil so that it is hidden. Instead of knotting the ends of the raffia while binding the basket, always fold them to the left and conceal them within the coil, locking them in place with following stitches. To give the desired shape to the basket, simply turn the coil of needles inward or outward during the course of the work. The needles should be held in a firm coil and each stitch of raffia drawn tightly. You will enjoy the work more and finish with a better looking basket if you take your time, grasping the work firmly but not tiring yourself by clutching it in a viselike grip.

Fitting Mitered Baseboard Around Irregular Corners



transferred to the work from a layout made on the floor. For example, when fitting baseboard around the edges of an archway, as in the drawing, hold a short length of the baseboard against the three faces of the

In many cases, mitering baseboard 45 deg. to fit it around corners will not result in perfect-fitting joints because of the fact that the wall corners are not true right angles. However, it is easy to cut baseboard to fit neatly around irregular corners if the cutting points are

archway and draw lines on the floor. Next, set in place the board which is to fit across the edge of the arch and transfer points A and C. Then, without moving the board, transfer points B and D. Using a try square, extend A and C to the top of the board and join them with B and D as shown. This will indicate the correct angle of cut for both ends of the work. Simply repeat this procedure for marking the baseboard running along both sides of the wall.

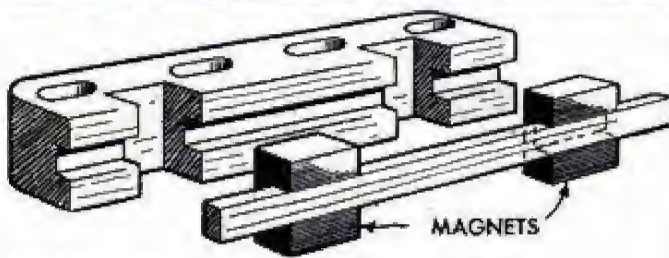
Verne E. Enz, Jeannette, Pa.

Garments Steamed Over Bathtub

Steaming wrinkles from wool or crepe garments can be done right in the bathroom. Hang the garments over the bathtub on coat hangers and then run hot water into the tub until the room is filled with steam. Air the clothes overnight.

MINIATURE CLOCKCASE

By M. B. Birge

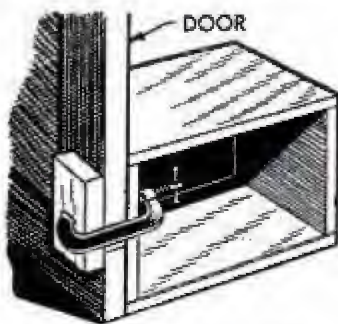


Magnetic Toothbrush Rack Sticks to Metal Door

The inside of a medicine-cabinet door is probably the handiest place in the bathroom for mounting a toothbrush rack, except that if the door is of metal, the rack cannot be fastened with screws or glue. If this is the case, make this neat hardwood rack, fitting it with two permanent magnets which will hold it securely to the inside of the door and yet permit easy removal for cleaning. The rack is drilled for the brush handles and notched on the rear face to receive the magnets. A spline glued in a groove holds the magnets in place.

David B. Thoms, Winchester, Mass.

Wooden Box Supports Door For Planing Edge



Elaborate bracing setups to support a door on edge for planing and setting hinges are not necessary if a heavy wooden box is available. Just use a C-clamp to fasten the door to the side of the box,

inserting a wooden block between the clamp and the door so that the surface is not marred by the clamp jaw.

Robert Hoppough, Encino, Calif.

REPRODUCED in miniature, this authentic replica of the quaint double-steeple clock makes a handsome desk accessory or wall-shelf ornament. If made proportionately larger, it is also an interesting piece for the fireplace mantel. The clock works are taken from an alarm clock and bolted to a sheet-metal mounting plate which is set against cleats glued to the inside surfaces of the case. The face of the clock is carefully drawn on white paper and cemented to the front of the mounting plate, the latter being drilled for the shaft. The front of the clockcase is covered with two glass panels. These are held between $\frac{1}{8}$ -in. frames glued to the sidepieces and the slanted top. Decorative pictures or paintings are applied to the glass except for the section directly in front of the clock face, as shown in the photo.

Note that the $\frac{3}{8}$ -in. base and the $\frac{3}{16}$ -in. shelf are grooved to receive tenons on the ends of the sidepieces. These grooves terminate $\frac{1}{16}$ in. from the front edges of both the base and shelf so that the sidepieces are set back from the front edges. In addition, the groove must be located $\frac{1}{4}$ in. from the edge of the work to allow $\frac{1}{8}$ in. overhang at the sides.

The steeples are $\frac{7}{16}$ in. square and $1\frac{1}{2}$ in. long, having the upper half tapered to a sharp point. This can be done by cutting and sanding to shape or by turning the steeples two at a time in the lathe. The steeples are glued to the front corners of the shelf and in $\frac{1}{4} \times \frac{1}{4}$ -in. notches cut in the edges of the roof. The back of the case consists of two sections of $\frac{1}{8}$ -in. mahogany, plywood or hardboard. The upper section is fitted with pins along the lower edge which engage holes drilled in the shelf, and the peak is held against a stop block by means of a sheet-metal tab screwed to the roof panels. The bottom section may be mounted permanently with glue or hinged on the inside to provide a "secret" compartment for storage of valuables.

After assembly, the front edges of the case are rounded and smoothed with fine sandpaper. Then the case is finished with a dark stain or simply finished in the natural color with several applications of paste wax. Take special care in fitting the joints, as good joinery in this instance is particularly important to the appearance and craftsmanship of the finished product.

WOOD-FINISHING

By Edward R. Lucas

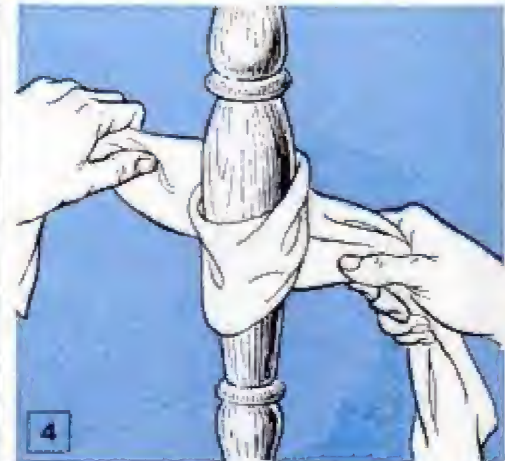
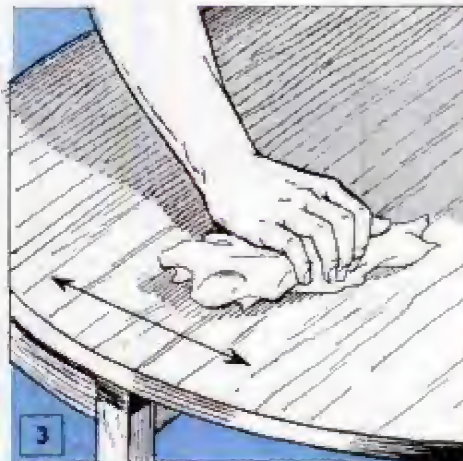


AFTER you've finished building that homeshop project from fine woods and have spent a little time admiring the design and workmanship, you'll probably be all set to tackle the job of applying a suitable finish. It's likely you've already visualized the type of finish you want. This may require reproducing the aged patina of some museum piece, or perhaps you will require the light colors and grained wood of up-to-the-minute modern. Either finish can be made up to suit your taste simply by mixing and blending the finishing materials yourself from separate ingredients.

First, the wood must be thoroughly sanded to produce a smooth surface free from scratches, ripples, dents or other irregularities. From there on the procedure depends on the color desired and the kind of wood used. Open-grained woods, such as oak, walnut, mahogany and ash will require a filler. On some woods this should be applied before staining. A good general-purpose filler is mixed according to formula No. 1, Fig. 6. On open-grained woods, such as oak and ash, which are to be finished in a light color, this filler can be used without the addition of oil colors. Mix the ingredients in a clean container, Fig. 1, and stir until the mixture is of a creamy consistency. Then apply with a brush, Fig. 2, and when the filler has set, rub off the excess across the grain with a coarse cloth, Fig. 3. When the filler is applied to turnings, use the cloth as in Fig. 4. After the filler is completely dry, sand it lightly and dust thoroughly. A painter's tack rag is best for picking up dust. Even though grained woods are to be finished in a light color, or natural, it is best to apply a light stain to serve as a means of uniforming the



Many finishers prefer to mix their own wood fillers from separate ingredients. Mix in a clean container



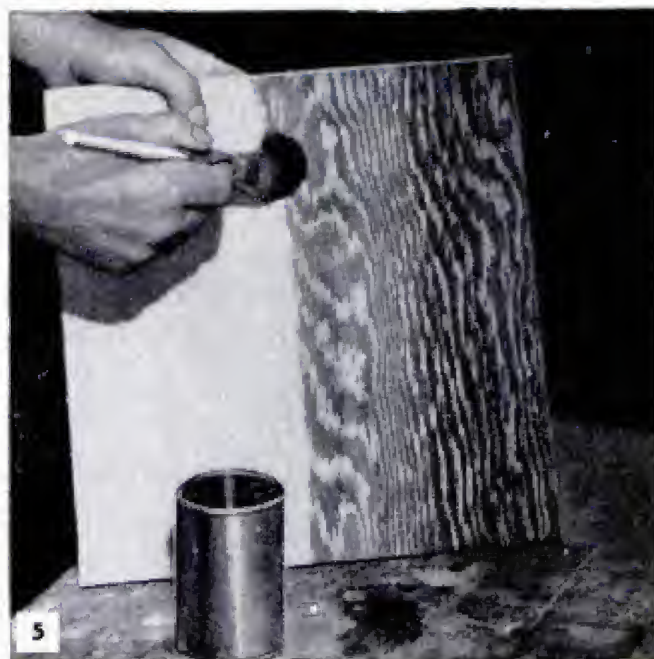
Mix the filler to the consistency of cream and apply to the wood with a brush. Allow to set, then rub across the grain with a coarse cloth. When rubbing turnings, wrap cloth around work and pull back and forth

FACTS AND FORMULAS

natural color of the wood. A stain made up as in Fig. 7, formula No. 5, with just enough raw sienna in oil to color the mixture, results in a beautiful natural finish on oak and ash, as well as on the close-grained woods such as birch and maple. The thing to do, if you are working for a specific color or shade, is to try the stain on a test panel of the same wood, as in Fig. 5. Several tests may be necessary before you get just what you want.

On the darker woods such as walnut and mahogany, the No. 1 or No. 2 formula, Fig. 6, will make a satisfactory filler but it will be necessary to add a small amount of either raw or burnt umber to the mixture so that the filler will blend with the natural color of these woods. If the finish is to be red mahogany, then add to the filler the same stain that is to be used in coloring the wood. As a rule, it is best to use filler formula No. 2 when the wood is to be finished in the darker colors, although this filler is much slower in drying. Because of the fine "grain" of the filler mixed as in the No. 2 formula, it is necessary to wet-sand it after application, continuing the sanding with fine-grit sandpaper until the liquid disappears from the surface. Then rub across the grain with the palm of the hand until the excess filler rolls and bunches under the palm. Remove this with a fine-mesh cloth and wipe the surface lightly until it is dry. After the filler is thoroughly dry, sand again with fine-grit paper until the surface is glass-smooth to the touch. Then, unless the wood is to be stained, finish with two coats of white shellac, the first coat being diluted 50 percent with alcohol. This method results in a clear-toned sheen comparable to results obtained by French polishing. The same methods can be used in finishing woodwork which will be exposed to weathering, as it is one of the most durable of all natural finishes. When finishing an outside door, rub petroleum jelly into the end grain at the top and bottom as in Fig. 10.

On nearly all close-grained woods a sealer is substituted for the filler and where a stained finish is desired, the two colors of automobile lacquer, Fig. 7, formula No. 3, are all that are needed, as these two colors can be used in varying proportions to give almost any shade desired from light red cherry to dark mahogany and brown or dark walnut. Any stain mixed from the ingredients listed dries very fast; final finishing coats can be applied in from 30 minutes to one hour after applying the stain. The body of the stain, that is, its coloring



When working with stains that penetrate quickly and dry fast, always check results on test panels cut from the same wood as that which is to be finished

6

FILLERS

Formula #1*

1/3 pint linseed oil
2/3 pint turpentine
Tablespoon Japan driers
Household cornstarch thickener
(add to suit)

Formula #2*

1/2 pint mineral turpentine
1/2 pint linseed oil
Heaping teaspoon litharge

7

STAINS

Formula #3

Black automobile lacquer
Cardinal red automobile lacquer
Lacquer thinner

Formula #4

1/2 pint hydrochloric acid
1/2 pint acetic acid
Wad of fine steel wool
Dilute with water as needed
after steel wool has dissolved

Formula #5*

1/8 pint linseed oil
1/8 pint turpentine
Japan driers
Colors in oil (raw sienna,
burned sienna, raw umber)
Small amount flat white paint

*Caution: Always burn rags immediately after using. Driers are extremely liable to spontaneous combustion.



A novel and useful method of staining native woods is to make spaced marks across grain with a wax crayon, then spread color with cloth dampened in lacquer solvent



capacity, can be varied from opaque through various degrees of shading stain to a very light tint suitable for light finishes. The variations are accomplished by changing the proportions of the body colors and increasing or decreasing the amount of thinner as required. Before applying this type of stain, check results on test panels.

Formula No. 4, Fig. 7, produces what might be called an aging stain on most of the common native cabinet woods but it also is very effective on certain imported woods which will not accept ordinary stains satisfactorily owing to the high oil content. This is a water stain and, in order to produce desired results, it must be applied with care. Try it on test panels first to be sure you have the required shade. (Caution: In the undiluted form hydrochloric acid is a violent poison. It also causes severe burns on coming in contact with the skin. The fumes are toxic. Destroy all unused portions of the acid or acid solution.) By adding a small amount of ni-grosine (soluble in water) to the stain solution given in formula No. 4, close-grained woods such as poplar, birch, maple and basswood can be stained an ebony black which is very attractive on certain types of woodwork such as picture frames and

shadow boxes. The regular solution is especially effective in staining woods to obtain the effect of age. Shading of the stain is done merely by changing the proportions of stain and water. By making tests on small panels of the same wood as that to be finished, you can get almost any effect.

Another rather novel method of staining which is quite attractive on both the open-grained and close-grained domestic woods is the use of wax crayons. Simply make spaced marks across the grain with a crayon of the color desired, then rub with the grain using a cloth dampened in a lacquer solvent, Fig. 9. The solvent dissolves the crayon marks and spreads the color evenly over the surface. The depth, or body, of the color is determined by the spacing of the marks on the wood. Close spacing produces a heavy-bodied color, wide spacing a light, thin stain.

Top finishing materials most commonly used after filling and staining, or staining and sealing, as the nature of the work may require, are shellac, varnish of various kinds and clear lacquer. Spraying lacquers can be applied only with a spray gun, but brushing lacquers are laid on with a well-filled brush, just as varnishes are applied. Drying time ranges from 10 to 30 min. Shellac takes from 1 to 3 hrs. to dry ready for a second coat, although it is dry to the touch in 15 to 20 min. Drying time for varnish depends on the type used, but it may range from 4 to 48 hrs. All these materials will require light sanding between coats in order to produce a first-class surface. The final coat usually is rubbed to a dull gloss with rubbing compound, Fig. 8. On certain native woods, some finishers prefer a wax finish. Two coats of shellac will form a good base for applying the wax.

Picket "Basket" Protects Shrubs

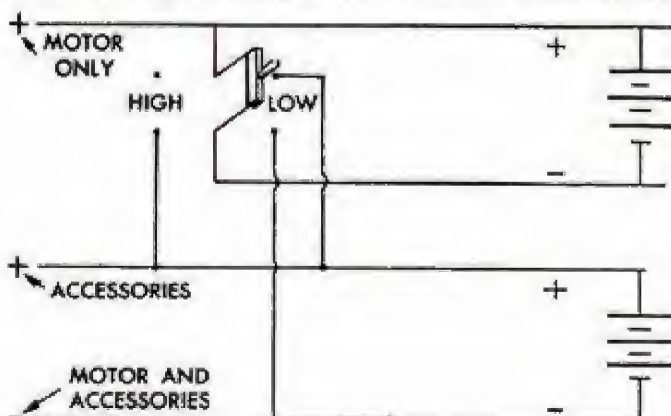
Individual shrubs and flowers can be protected from damage by pets and romping children and made much more attractive if they are ringed with a picket basket. For a basket approximating the size of the one pictured, use 17 pickets, $1\frac{3}{8}$ in. wide by 14 in. long. Drill $\frac{1}{16}$ -in. holes through the edges of the pickets near the top and bottom and counterbore larger-diameter holes partially through the two end pickets. Use two lengths of galvanized wire to string the pickets, the bottom length being $27\frac{1}{4}$ in. long and the top length $32\frac{1}{2}$ in. long. After stringing all the pickets on the wire, twist it an inch or so from the end so that it will not pass through the smaller hole in the starting pickets but can be inserted in the counterbored portion of the hole. Then twist the two ends together and move the finish picket so that the twisted ends are hidden in the counterbored holes. Space the pickets about $\frac{1}{2}$ in. apart along the upper wire and $\frac{1}{4}$ in. apart along the bottom wire to attain the tapered effect.



Before assembling the basket, paint the pickets with two coats of the desired color.
Dick Hutchinson, El Monte, Calif.

Speed of Battery-Operated Toys Controlled by High-Low Circuit

Often it is desirable to operate battery-driven toys, which are powered by two or more cells, at a speed lower than normal.



This can be done by arranging the wiring as in the diagram, using two dry cells, or groups of dry cells. A d.p.d.t. (double-pole, double-throw) switch is placed in the circuit as shown. Throwing the switch to the high position connects the cells in series, making the full voltage available. When the switch is thrown to the low position, the cells are connected in parallel and the voltage is reduced by one half. This reduces the speed of the model and also conserves the batteries. If there are accessories, such as lights, which require the same voltage at all times, connect these to terminals on the leads as indicated.

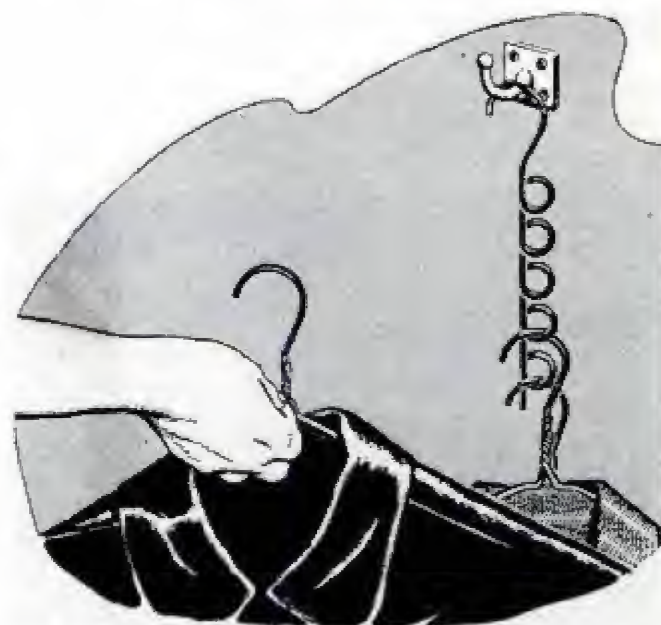
Charles Erwin Cohn, Chicago.

Multiple Clothes-Hanger Rack Conserves Closet Space

To conserve space in a small closet or to hang several suits or coats in the car while traveling, bend this multiple hanger rack from a wire coat hanger. Just straighten out the wire, bend it into several loops as shown, and slip the hook of a coat hanger through each loop. Be sure to make the rack from a heavy-wire hanger so that it will withstand the excessive weight.

John Torhan, Yonkers, N.Y.

¶ If you want to read the voltage and wattage of a light bulb without turning it off, just hold a sheet of white paper against the end of the bulb. The numbers on the glass will be legible through the paper.



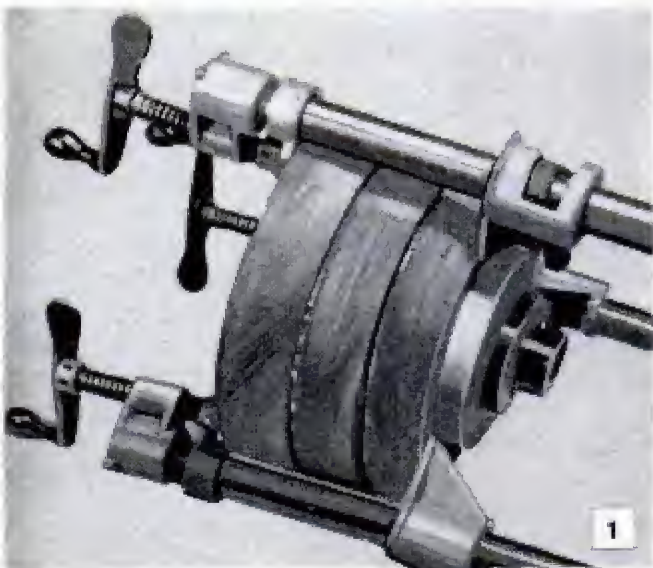


A tenon is formed around the edge of the bottom disk to fit a matching groove turned in the second piece



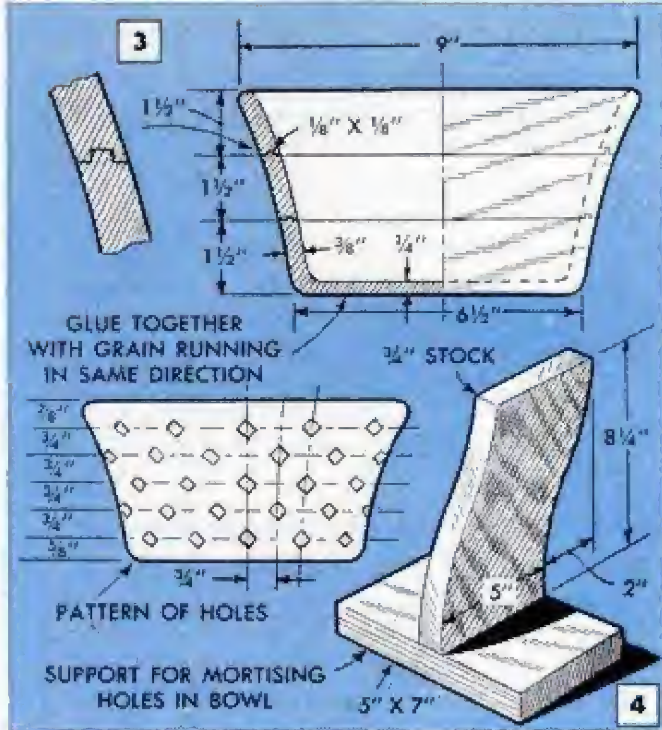
INTRIGUING

HOW DID YOU make it? That's the first question your craft friends will ask when they examine this unique fruit bowl. They'll see right away that it was first turned, but how the square holes were formed usually will keep them guessing. Oddly enough, the piercing of the bowl is actually the easiest part of the whole job for it's done merely with a mortising chisel in the drill press. The bowl itself is a typical turning job, being turned from either a solid block or three separate pieces glued and clamped together as shown in Figs. 1 and 3. Note in Fig. 1 that the bottom section of the built-up block is glued to a waste block for attaching a faceplate. The outside of the bowl is turned to final size and sanded smoothly at this time but, on the inside, the wall thickness is left about $\frac{1}{8}$ in. oversize. This is done to provide waste to take care of any chipping that occurs when piercing the bowl. Fig. 3 shows how the outside of the bowl is marked off to locate the points for piercing. A $\frac{1}{2}$ -in. mortising chisel is used, as well as a jig to support the bowl. This is made of wood as in Fig. 4 and is clamped to the drill-press table as shown in Fig. 5. Ease the chisel through the work slowly in making each hole to prevent excessive chipping. After the piercing is completed, the bowl is remounted in the lathe and the inside is turned down. This operation requires extreme care and the use of a very sharp, pointed tool. Finish by touching up the holes with a square file, sanding and giving the bowl a French polish of shellac and sweet oil while it is still mounted in the lathe.

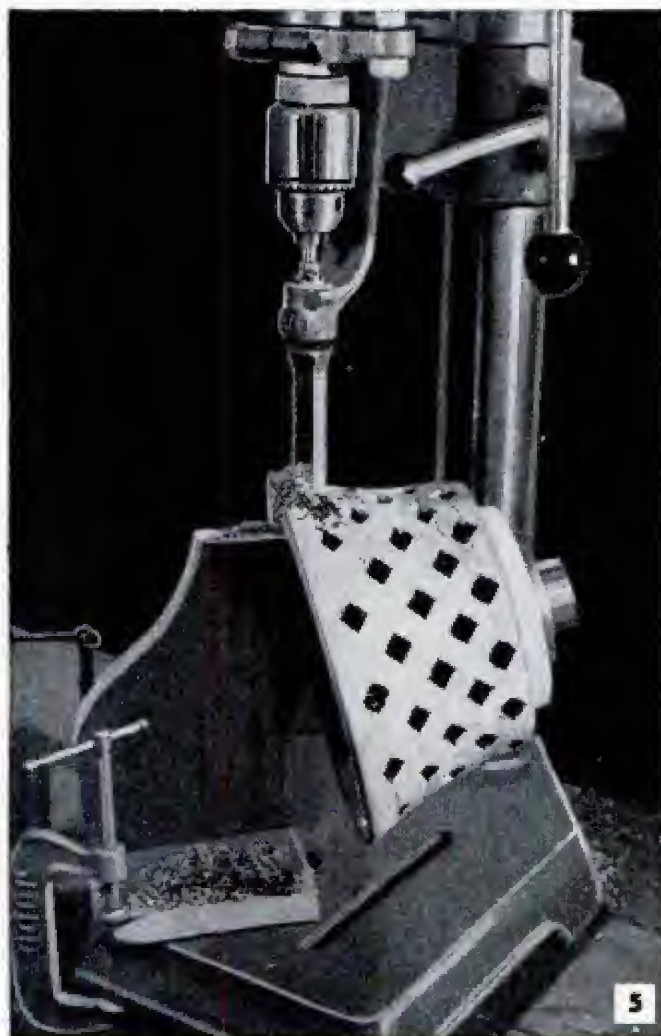


Above, built-up assembly with faceplate attached is glued and clamped. Center of two disks is removed beforehand. Below, the inside is turned after piercing





FRUIT BOWL

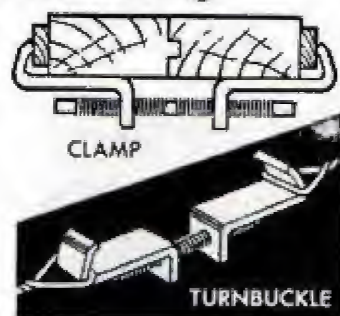


In piercing the bowl, it is held on a wooden standard. Note that this is clamped to the base of the drill press at a 45-deg. angle. Ease the mortising chisel through the work and hold the bowl firmly when the chisel begins to break through. The faceplate is left in place so that the bowl can be replaced for final turning

Toe Clamps Salvaged From Skates Hold Small Work for Gluing

Before throwing away an old pair of roller skates, remove the clamps and save them. They will come in handy as gluing clamps for small work and turnbuckles when gluing larger work. Although pliers can be used to tighten the clamp, a roller-skate key is more convenient.

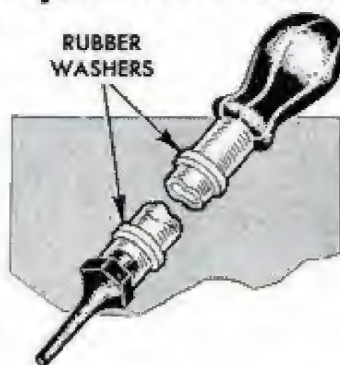
Edward F. Kmiec, Flushing, N. Y.



Washers Protect Hydrometer Glass

To minimize the danger of breaking the glass cylinder of a hydrometer when it is accidentally bumped or dropped a short distance, slip several rubber garden-hose washers over the gauge glass. This, of course, is not foolproof protection, but it will prevent damage from minor accidents.

Victor H. Lamoy, Upper Jay, N. Y.

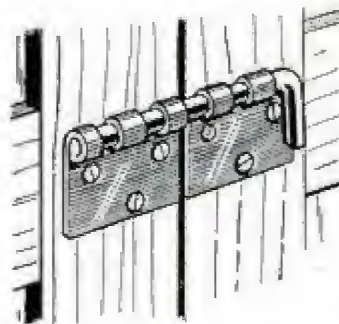


Loose-Pin Hinge Forms Door Bolt

Suitable for a garage or shop door, this sturdy bolt can be made quickly from a large loose-pin hinge and a length of rod. The original pin is removed from the hinge and the leaves are aligned side by side and screwed in place. The decorative pin button on one leaf can be left in place or removed as desired. Then the rod, which should be slightly smaller in diameter than the hinge pin, is chamfered at one end, to facilitate sliding it in place, and bent at right angles at the other end to provide a handle.

A drop or two of oil applied to the bolt will improve operation. To assure perfect alignment, it is best to screw the hinge parts in position with the sliding bolt in place.

Warren W. Howe, Longview, Wash.



☐ A cake of soap provides a handy pin-cushion for baby's bathinette and at the same time will keep the pins lubricated.

Simulated-Leather Table Tops Improvised From Hardboard Panels



Hardboard panels having a leatherlike finish are just the thing to simulate expensive leather table tops. Fitted carefully into the recessed top of a cocktail or occasional table, the hardboard panels are difficult to distinguish from real leather. The panels are practically unbreakable, quickly removed for dusting and easy to wipe off. The hardboard can be sawed, the edges sanded like plywood and the surface finished with paste wax.

Edward L. Fisher, Milwaukee, Wis.

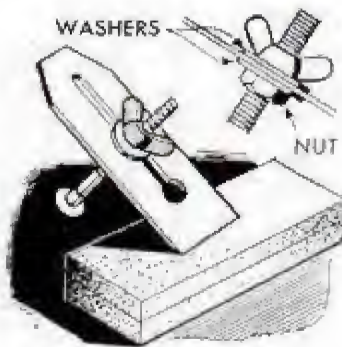
Portable Open-Fire Cooking Grill Swings Meal Clear of Flames

Built from scrap pipe and iron rod, this portable campfire grill is quickly set up and has the advantage of allowing the entire meal to be swung on or off the fire. A length of pipe or $\frac{1}{2}$ -in. rod about 3 ft. long is embedded in the ground to support the movable grill, and a collar clamped to the upright by means of a thumbscrew permits the grill to be set to any desired height. The grill itself is a frame of $\frac{1}{4}$ -in. rod welded to a 12-in. length of pipe which fits loosely over the upright.

Perry E. White, Oklahoma City, Okla.

Bolt Supports Plane Blade For Sharpening Edge

To do a good job of sharpening the blade of a plane on an oilstone, it is important to support the blade at the proper angle to the stone. This can be done easily by using a long, roundheaded bolt to hold the cutter



at a constant angle. Fasten the bolt in the blade slot with a nut, two washers and a wing nut, as shown. Set the oilstone on a flat surface, such as a bench top, and place the edge of the blade on the stone. Then adjust

the blade to the desired angle by turning the nut down the bolt threads or backing it off and then locking in place with the wing nut. After the correct angle is attained, sharpen the blade in the usual manner.—Ted J. Kubit, Detroit, Mich.



Separating Fishing-Rod Ferrules Without Damage

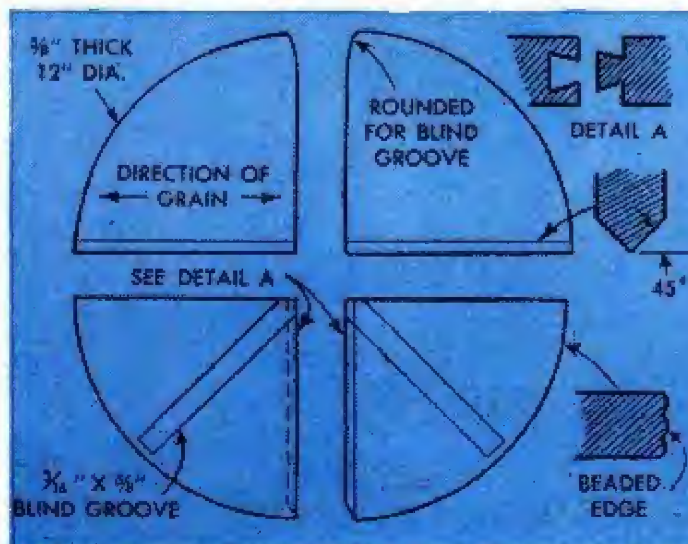
Ferrules of fishing rods that have not been taken apart before storing often corrode, making separation difficult without exerting pressure that might damage the rod. To separate the corroded ferrules, apply a few drops of carbon tetrachloride in and around the joint, and allow it to remain for a half hour so that it penetrates and dis-

solves the corrosion. After this, the rod sections will come apart easily. Remove the rust spots with fine emery cloth and coat the ferrules with a light oil before putting the rod sections back together.

☞ An electric baby-bottle sterilizer is just the thing for sterilizing jelly glasses.

TWO SHELVES OR ONE

By
Benj.
Nielsen



You're in for a change with this novel two-in-one shelf for, when you are tired of using it as a plain wall shelf, it can be slipped apart and used as two separate corner shelves. Primarily, it's a lathe job, although a power saw is needed to form the dovetail joint which locks the two shelves together. Both shelves are made from a 12-in. disk which is faced $\frac{3}{8}$ in. thick and beaded around the edge. The disk is cut into four equal segments, producing two brackets which are beveled along one edge as shown, and two top pieces which are dovetailed along the end grain. The brackets are glued in shallow grooves routed or dadoed in the underside of the top pieces. Note that these are made blind at the front



Discoloration of Steamed Wood Prevented by Cloth Wrapping

When it is necessary to steam wood in order to bend it to suit the design of a boat or piece of furniture, the possibility of discoloration can be eliminated by wrapping the wood in clean rags. Tie the rags securely to the wood so that they do not slip off during the steaming process. As the wood should not come in actual contact with the water, place a block of wood at the bottom of the container and keep the water level just below the top of the block.

Sherwood Benson, Minneapolis, Minn.

Rifle Supported Against Car Fender With Suction-Cup Bracket

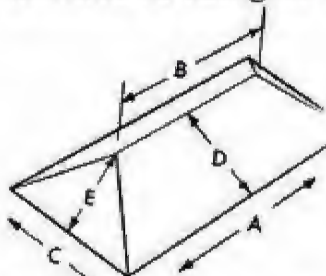
While target-shooting or hunting, the fender of your car often is the most convenient place to lean the rifle. However, this practice is extremely unsafe, as the rifle is likely to fall to the ground and possibly discharge.



A handy item to include in your gear is a suction-cup bracket which can be mounted on the car body to support the rifle without danger of its falling. To make the bracket, just screw a U-shaped metal clip to a suction cup and, if desired, cement felt to the inner edges of the clip to protect the rifle barrel.—Robert P. Arce, Hawthorne, Calif.

Estimating Hip-Roof Area

Here is a simple way to find the total area of a hip roof when determining the amount of shingles or roll roofing it will take.



First, add the length of eave, A, to the length of ridge, B, and multiply the sum by the slope, or rafter length, D. Then multiply the eave, C, by the slope, E.

Merely add the two answers in order to obtain the total roof area.

A. L. Kaser, Niles, Mich.

Foot Scraper Utilizing Pipe Lengths Has Handhold for Better Support

An efficient foot scraper is a must on the farm and in newly built suburban communities where sidewalks are scarce and the mud is thick. This scraper has a handhold across the top so that you can grasp it while cleaning the shoes, thus gaining the balance necessary to do a thorough job. Two pieces of pipe several feet long are joined at one end by welding a short length of pipe across the ends. Then a piece of flat iron, which forms the scraper, is welded between the vertical pipes 18 in. or so from the top. The pipes are driven into the ground until the flat-iron scraper rests on the surface.

A. M. Wettach, Mt. Pleasant, Iowa.



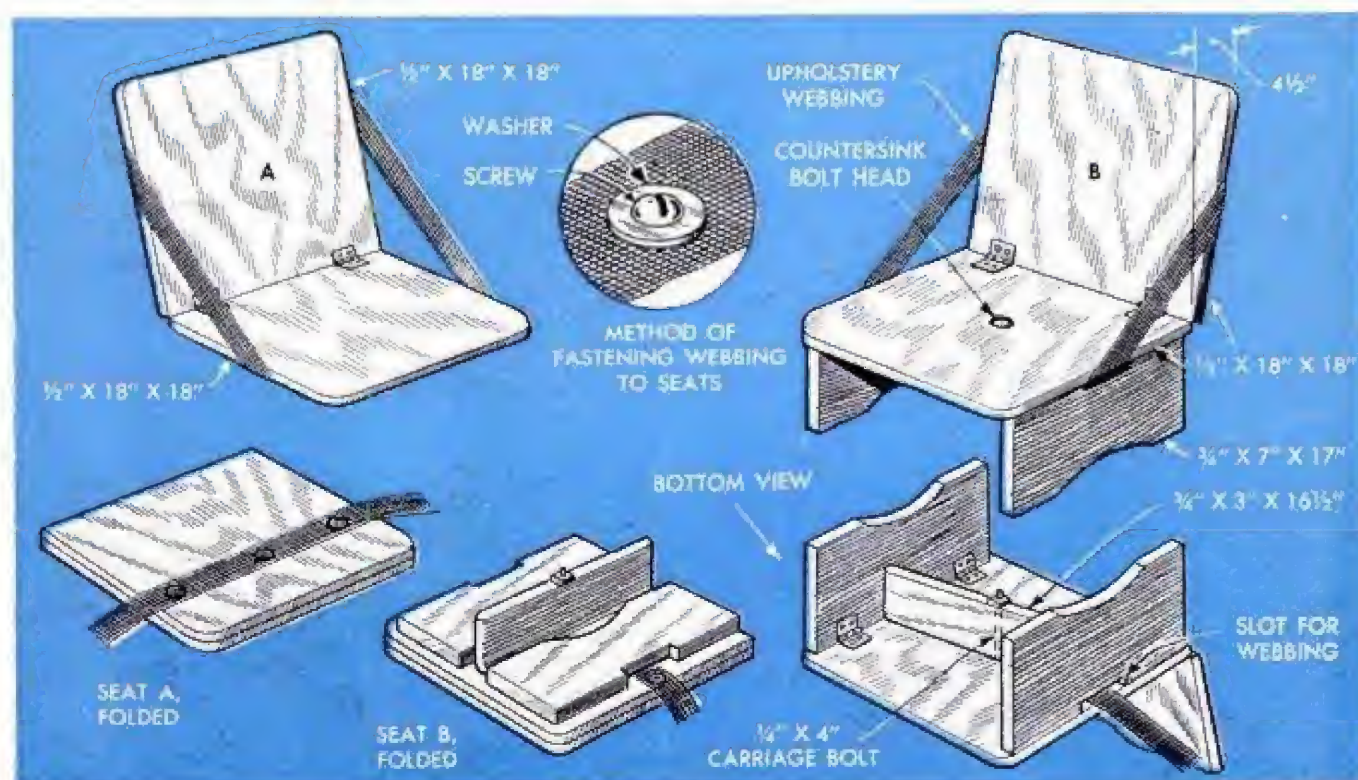
¶ To remove a paint spot from fabric, saturate the spot a few times with a solution consisting of equal parts of turpentine and household ammonia. Then wash the area with soap and water.

SEATING YOUR TV AUDIENCE



WHEN a group of friends and their children drop in for an evening of TV, the smart host takes the seating problem in stride and brings out these novel "down in front" chairs to give everyone a box seat. Reserved for young Hopalong fans and teen-agers, the chairs augment the regular room furnishings and also permit the audience to be seated on three levels so that all can see without craning. Made in two sizes, the chairs are used down front—the low seats for small fry, with older children

being ushered to the higher ones. Several of each type can be made and, as they fold, they can be tucked away in a closet. Both chairs, which are detailed below, are made from solid stock and plywood. Style B is a duplicate of style A, except that a hinged base is added to bring the seat about 7 in. above the floor. The hinged backs are supported when open by strips of upholstery webbing. The webbing is fastened in place with short roundheaded screws and washers.—Hi Sibley, Nuevo, Calif.





LONGER LIFE FOR FENCE POSTS

Preservative treatments for prolonging the life of fence posts can be carried out on the farm or in the wood lot at a minimum cost in time, labor and equipment

By Robert Donald Sawyer

ACCORDING to Richard W. Abbott, assistant extension forester at the University of Wisconsin, simple preservative treatments now are being carried out which will lengthen the life of wooden fence posts from 8 to 15 years. Wood of the different tree species suitable for fence posts varies greatly in durability. As shown in the table, Fig. 5, some durable woods such as cypress, Osage orange, black locust and redwood have a serviceable life as fence posts ranging from 15 to 25 years without any protection other than the natural oils contained in the wood itself which are toxic to ordinary wood-rotting organisms. Other less durable woods, widely used because of the high cost and relative scarcity of the durable varieties and also because they are readily available locally,

are destroyed in a relatively short time unless protected by preservative treatments. Compare the condition of the posts in Figs. 2 and 6. The post in Fig. 2 has been treated; the other (untreated) post shows the progress of decay through the sapwood after only a few years of service. Note also from the table that after treatment with a preservative the serviceable life of the less durable woods compares favorably with that of the most durable varieties.

Posts selected for treatment with preservatives should be round and about 4 to 5 in. in diameter at the top end. In the non-pressure method of treatment, the heartwood of most varieties will resist the penetration of the preservative and it is for this reason that only round, unsplit posts are used. In treating with the common chemicals it generally is recommended that the bark be peeled immediately after cutting, Fig. 1, and that the posts be stacked to season as in Fig. 3. However, some treatments can be carried out without removal of the bark, as will be noted later. Bark of most of the common trees suitable for fence posts peels most easily in the early

Bark should be peeled from each post immediately after cutting and while the sap is still fresh

Treated post shows no signs of decay after several years of service. Note smooth surface below ground





After peeling, posts are stacked to season thoroughly before treating by cold soaking

spring when the sap begins to rise. That's why farmers plan to cut the season's replacement posts at this time. Before cutting post timber, it's a good idea to go over the wood lot and mark trees suitable for cutting during that season. When cutting, special attention should be given to removal of interfering growth, Fig. 4.

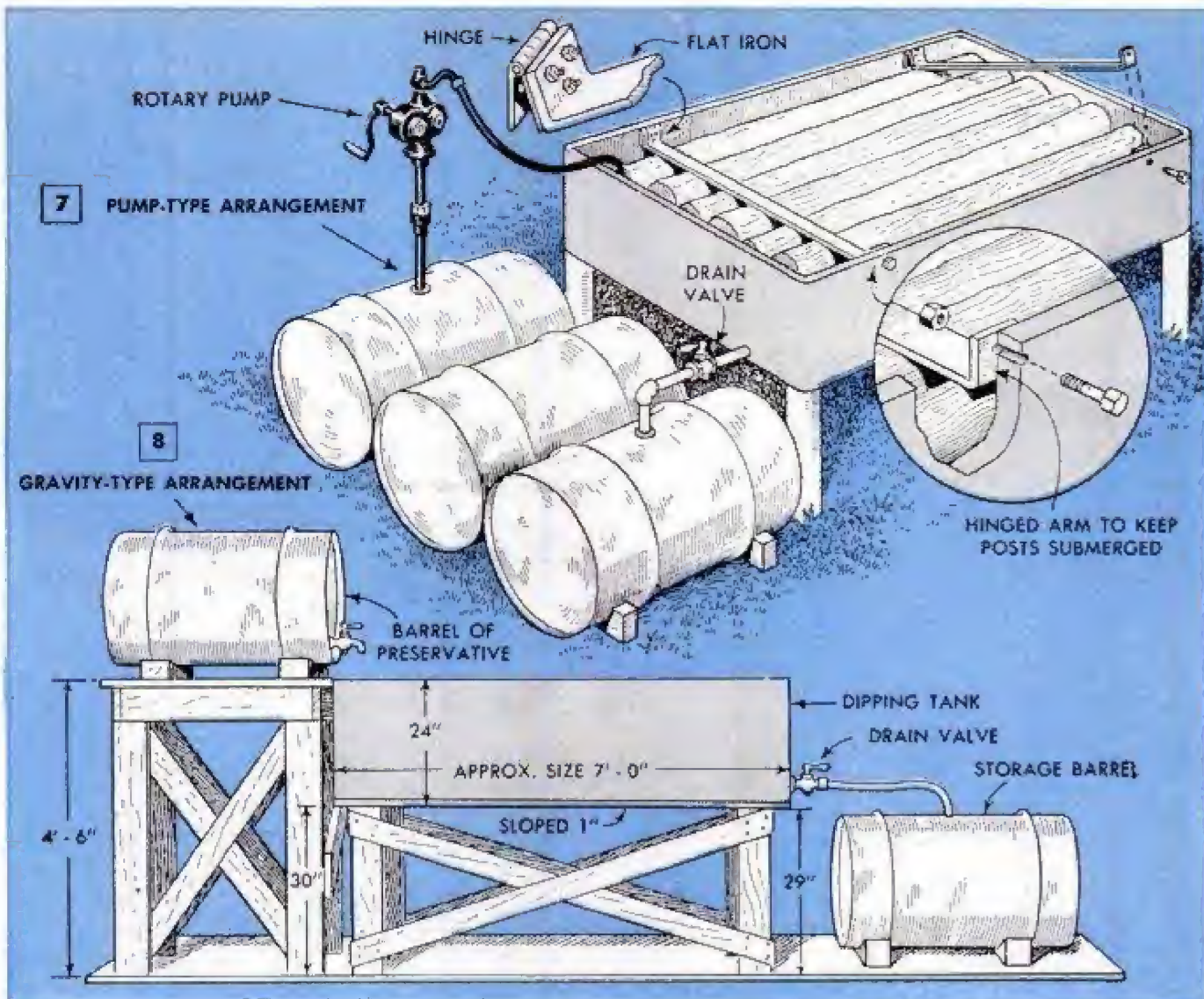
In general, there are three methods of nonpressure treatment, the open-tank, or "cold soaking" method, being the easiest and simplest, using as a preservative a mixture of equal parts of creosote and crankcase oil. Various tanks can be used but the set-ups pictured in Figs. 7 and 8 have proved the most satisfactory. In the first system a pump is used to draw the preservative solution from the drums and force it into the sheet-metal vat. The latter is specially made for the purpose and is generally designed to hold at least 12 posts submerged for treatment at one time. Special hold-downs are provided to force

Decay of some untreated posts progresses to this stage in three to five years' time



When cutting posts, good forestry practices should be observed by removing interfering growth and thinning wood lot uniformly

5 EXPECTED LIFE AND RECOMMENDED TREATMENT FOR FENCE POSTS OF DIFFERENT SPECIES						
Species	Resend Only	Split	Expected Life Without Treatment (In Years)	Recommended Treatment		Expected Life After Treatment (In Years)
				Cold Soaking	Hot and Cold Bath	
Aspen (poplar)	X		2-3		X	15-20
Basswood	X		2-3		X	15-20
Beech	X		3-5		X	15-20
Birch, river, yellow	X		2-4		X	15-20
Black Cherry	X		6-9		X	15-20
Black Gum	X		3-5		X	15-20
Black Walnut	X		10-20		X	15-20
Buckeye	X		3-5		X	15-20
Butternut	X		6-9		X	15-20
Catalpa	X		10-20		X	15-20
Cedar, red	X	X	15-20		butts only	20-25
Cedar, white	X	X	15		butts only	20
Chestnut	X		10-20		X	15-20
Cottonwood	X		3-5		X	15-20
Cypress	X	X	20-25	not necessary		15-20
Douglas Fir	X		10-20		X	15
Elm	X		4	72 hrs.		15-20
Fir	X		3-5		X	15-20
Hemlock	X		6-9		X	15
Hickory	X		5	72 hrs.		15-20
Honey Locust	X		10-20		X	15-20
Hornbeam	X		3-5		X	15
Loblolly Pine	X		6-9	X		not necessary
Lupine black	X	X	20-25	not necessary		15-20
Longleaf Pine, dense	X		10-20	X		15
Longleaf Pine, nondense	X		6-9	X		15-20
Maple, hard, soft	X		2-4		X	15
Mulberry	X	X	20-25	not necessary		15
Oak, red, black	X		5	72 hrs.		15-20
Oak, white, bur	X	X	10	72 hrs.		not necessary
Osage Orange	X	X	20-25	not necessary		48 hrs.
Pine, white, red, jack	X		3-5	48 hrs.		X
Red Gum	X		6-9		X	not necessary
Redwood	X	X	20-25	not necessary		X
Rock Oak	X		6-9	X		15
Shortleaf Pine	X		6-9	X		15-20
Spruce	X		3-5		X	15-20
Sugar Maple	X		3-5		X	15-20
Sycamore	X		3-5		X	15-20
Tamarack	X		7-10		X	15-20
White Ash	X		3-5		X	15-20
Willow	X		2-3		X	15-20
Yellow Poplar	X		3-5		X	



the posts below the level of the solution and hold them in position. The vat is elevated sufficiently so that the solution will drain off into an empty drum through a drainpipe fitted with a shutoff valve as shown. In the gravity system, Fig. 8, the supply tank is located above the vat which also is elevated so that the solution can drain off into a storage drum. Either arrangement performs satisfactorily when used with the creosote-oil solution or with the new preservative consisting of a 5 percent solution of pentachlorophenol (pronounced "penta-klor-fee-nol") and oil. This newer solution is available ready-mixed for treating fence posts. **Caution:** Care should be taken in handling either the creosote-oil or pentachlorophenol-oil solutions. Wear rubber gloves when handling posts wet with the solution and take special precautions against a splash which might throw the liquid into the eyes or onto the bare skin. The treating unit should be located in the open away from buildings to reduce the fire hazard to the minimum, as the solutions used are flammable.

The amount of solution required will average about $\frac{1}{2}$ gal. per post. This will vary somewhat with the kind of wood.

Treatment should be carried out only during the summer months when the temperature remains above 60 deg. F. As noted in the table, Fig. 5, the duration of the single treatment ranges from 48 to 72 hrs. for the common woods. At the end of this time the solution is drained off and the posts removed. If there are more posts to be treated, the tank is refilled with a new solution and the process repeated.

A second method, which is the most effective of all treatments practicable on the farm, requires that the solution be heated to about 200 deg. F. The equipment required is essentially the same as that used in cold soaking, except that some provision must be made for heating the preservative in the tank. Usually it is possible to mount the tank over a firebox of brick or stone in which a controlled fire can be maintained for the time necessary to bring the solution to the required temperature. A half-and-half solution of creosote and oil is recommended for the hot-bath method. Use caution in heating this solution as it is highly flammable. The procedure is quite simple: Place the posts in the tank, pump in the preservative, bring it to the required temperature and

maintain it at this level for 3 hrs., then pull the fire. Allow the posts to remain in the solution at least 12 hrs. or overnight.

The third method of treatment, known as the tire-tube method, has lately come into favor because of the simple equipment required. However, it is not suitable for all woods used for fence posts. Only the fast-growing, nondurable woods are recommended for treatment by this method, as the posts must be treated while still green and without being peeled. The first requirement is a rack long enough to support several posts laid side by side with the large end (butt) about 18 in. higher than the small end. Place two up-rights in line with the large ends of the posts to support a bar about 18 in. above the ends. In use, the free ends of the inner-tube sections are attached to the bar to hold them in a vertical position when filled with treating solution. Peel the bark from the large end of each post for a distance of 4 or 5 in. Cut an ordinary tire tube into 20-in. lengths and double one end of each length back about 2 in. Slip it over the peeled end of the post and bind tightly with a piece of twisted wire. Then rack the posts and tie the free ends of the inner-tube sections to the crossbar.

Chromated zinc chloride is the recommended solution for treating posts by the tire-tube method. This is available ready for mixing with water and complete directions are furnished for preparing the solution. The amount of solution required for each individual post ranges from $\frac{1}{2}$ to $\frac{3}{4}$ gal., depending on the diameter and length of the post. A post 3 in. in diameter and 6 ft. long will require about $\frac{1}{4}$ gal., while a post 6 in. in diameter and the same length will require $1\frac{1}{4}$ gal. of solution for thorough treatment. Increase or decrease the amounts proportionately for longer or shorter posts, and those of varying diameters. Pour measured amounts of the solution into the open ends of the inner tubes and allow to stand until the preservative drips from the lower end of each post. Impregnation is accomplished by displacement of the moisture and sap present in the wood by the zinc-chloride solution. The pressure exerted by the head of liquid in the tire tube is sufficient to accomplish this in a comparatively short time, which, of course, will vary with the condition, or treatability, of the wood and the dimensions involved. Place a length of gutter under the lower ends of the posts to catch the drippings. In some cases, farmers mix a coloring agent, such as egg dye, with the solution in order to make it easier to determine when penetration is complete.

Photos and certain technical information courtesy University of Illinois and University of Wisconsin

Checking for Water in Fuel-Oil Drum

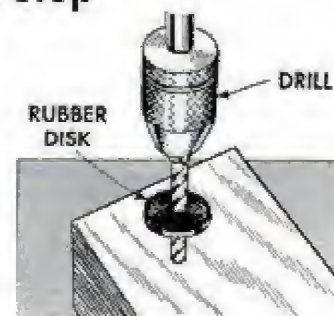


If you've been wondering just how much water has collected in a fuel-oil storage drum as a result of condensation and seepage through the vent, you can find out quickly with a piece of red litmus paper and a long stick. The litmus paper, which usually can be purchased in the drugstore, is tacked to the lower end of the stick as in the detail. Then the stick is held vertically and inserted through the bung until it touches the bottom of the drum. Any water in the drum will have settled to the bottom and will turn the litmus paper blue. Thus, the amount of water can be estimated by the depth of the color change in the paper. If the entire piece of paper should change color, use a longer piece and check again. Be sure that there is no sidewise movement when lowering the stick, and hold it against the bottom of the drum momentarily.

Jerome Toomey, Long Beach, Calif.

Hand-Drill Depth Stop

When drilling blind holes with a hand drill, it is next to impossible to gauge the depth exactly by eye. If you want to be sure that all the holes are just the right depth,



slip a rubber disk over the bit so that the tip projects the desired distance. Stop drilling when the disk contacts the surface of the work. The disk can be cut from $\frac{1}{16}$ to $\frac{1}{8}$ -in. sheet rubber and the center of the disk is slit to receive the bit.

Paul Woodruff, Chicago.

Stepladder Serves as Glazing Easel When Fitted With Folding Arms



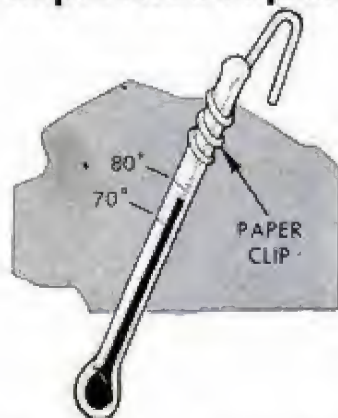
If a hook-shaped wooden arm is screwed to each leg of a stepladder, it takes only a moment to transform the ladder into a convenient easel for glazing window sash. The hooks are pulled outward when needed and pushed up along the leg when not in use. Stop blocks along the rear edge of the leg keep the hooks from dropping when the sash is rested on them.

Silk Hose Tests Sanded Surface

After sanding a wooden surface prior to painting, you can check the smoothness of the surface with an old silk stocking. Slip the stocking over your hand and rub it lightly over the sanded area. If the surface snags the stocking, further sanding is necessary for a smooth finish.

David Deutsch, Brooklyn, N.Y.

Improvised Aquarium Thermometer



A suitable thermometer for a tropical-fish aquarium can be made in a few minutes from an inexpensive wall-type thermometer. Mark the thermometer tube with dots of black paint to indicate the upper and lower temperature limits to be maintained in the aquarium. Then remove the tube from the backboard and paint a thin stripe around the tube at each dot. After straightening a paper clip, bend one end

in a spiral to fit snugly around the thermometer tube and bend the other end of the wire to hook over the edge of the aquarium. Even though the thermometer is easily read, it is not noticeable enough to mar the appearance of the aquarium.

Willard M. Burton, Miami, Fla.

Handy Lifter for Thumbtacks Formed From Picture Hook

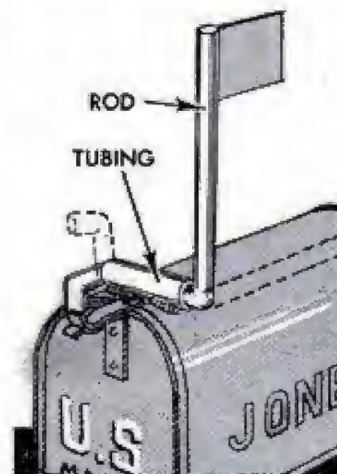
Changing shelf paper and other jobs that require removing thumbtacks are speeded by using this convenient little tool which is made from a picture hook. Just notch the small end of the hook and file the edge sharp. To use, slip the sharp edge under the head of the tack and pry up by rocking the large end of the hook.



William Swallow, Brooklyn, N. Y.

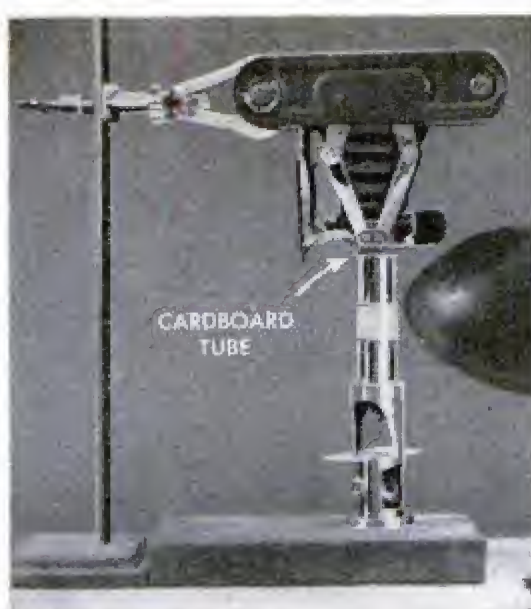
Novel Flag Arm on Mailbox Trips When Lid Is Opened

To make sure that the mailbox flag was lowered each time outgoing mail was removed from the box and thus save the mail carrier unnecessary stops, one man devised this novel flag arm which is tripped by opening the lid of the box. The arm consists of a length of rod bent so that it passes through a length of tubing and then down and in front of the mailbox lid, as shown in the drawing. The tubing, which is soldered to the top of the box, provides a pivot for the arm, and the portion of the arm which hooks over the lid of the box is bent slightly less than 90 deg. so that it is forced upward when the box is opened. The long upright portion of the rod is bent somewhat forward to keep the flag from falling before the arm is tripped. The flag is of sheet metal soldered to the top of the arm.



Vincent Serecin, Williamsport, Pa.

Creasing the edges of a necktie too sharply when pressing it can be prevented by cutting cardboard to the desired shape and inserting it between the folds of the tie.

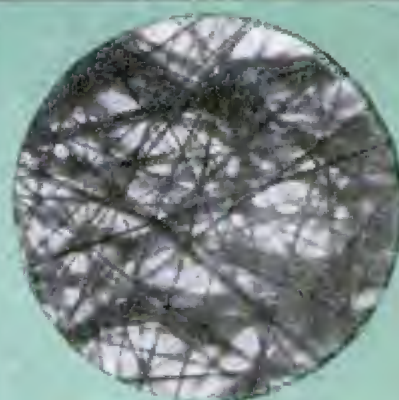


PHOTOS THROUGH A MICROSCOPE

By Victor Rodwell and Selwyn A. Marks

INTERESTING and informative photos can be made of minute objects by shooting them through a microscope. Any camera will do the trick, even a box camera, and your laboratory can be any convenient table top. Cameras of the bellows type or box type are preferable to the 35-mm. miniature, which would produce negatives so small as to require enlargement. A low-power microscope is best for most subjects, and a desk lamp of the adjustable type shown in the photos above is just the thing for lighting. The camera must be supported rigidly in the vertical position so that it overhangs the eyepiece of the microscope and at the same time is adjustable up and down. A laboratory ring stand like that shown is best, of course, but if this unit is not available, a suitable stand is easily improvised.

After setting up the microscope and focusing it on the subject, hold a sheet of thin white paper over the eyepiece and move it upward until the light disk projected on the paper is reduced to the minimum diameter. The camera lens must be placed at this point and directly above the microscope eyepiece so that the subject will be in sharp focus. Fit a small cardboard tube between the lens and the eyepiece to form a light-tight connection. Test shots for the purpose of correcting any chance errors in focusing or timing can be made on fine-grade printing paper. Remember that the image projected onto the film through the eyepiece is circular. To determine the size of the circular area, remove the back of the camera and substitute a piece of ground glass or wax paper. Then open the shutter and measure the diameter of the circle of light on the ground glass. Make a holder by cutting two pieces of masking paper to fit the ground-glass opening. Cut a square opening in one piece. Sandwich the printing paper between. Place in the camera and close the back to retain the improvised holder. Make several exposures, then develop and check results. Once the setup is proved correct, regular film can be used.



You wouldn't guess it, perhaps, but this is glass cloth, highly magnified



A mountain range, or what? It's part of the letter "K" on an engraving



Fine printing not ordinarily noticed on postage stamps looks like this

Lamp Stand Fitted With Novel Clamp Supports Reflector Near Floor



A photoflood reflector mounted on a light stand in the usual manner sometimes cannot be positioned near enough to the floor for desired lighting effects. In this case, use a wooden clamp to permit adjusting the reflector from a height of approximately 2 ft. down to floor level. The clamp is made from two pieces of hardwood notched near both ends to clamp over the light-stand shafts and drilled for a bolt and wing nut. To lower the reflector, remove the upper telescoping rod from the stand, invert the rod and clamp the end to the tripod standard as shown in the photograph.

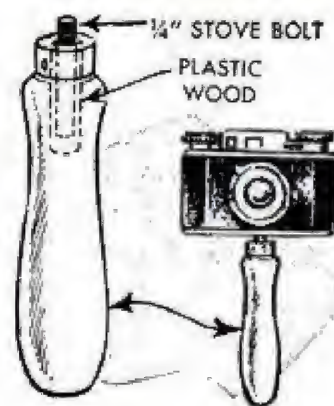
Frank T. Sokolik, Chicago.

Handle Steadies Candid Camera

If difficulty in holding a candid camera steady sometimes spoils otherwise perfect shots, try fitting the camera with a wooden handle which can be made at a cost of only a few cents. After

cutting the head from a $\frac{1}{4}$ -in. stove bolt, insert the threaded portion into a wooden chisel handle, using plastic wood to anchor the bolt in place. Be sure that the bolt is aligned with the handle, and allow the threads to project

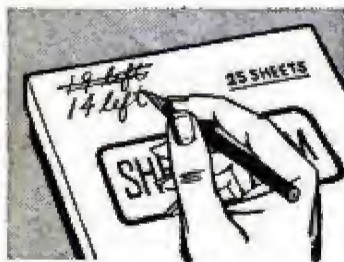
about $\frac{3}{16}$ in. from the top of the handle. To attach the handle to the camera, just turn the bolt threads into the tripod socket.



Inventory Kept on Film-Box Cover

When cut film is purchased in boxes of 25 or 100 sheets, it is easy to forget just how many sheets remain in the box after loading

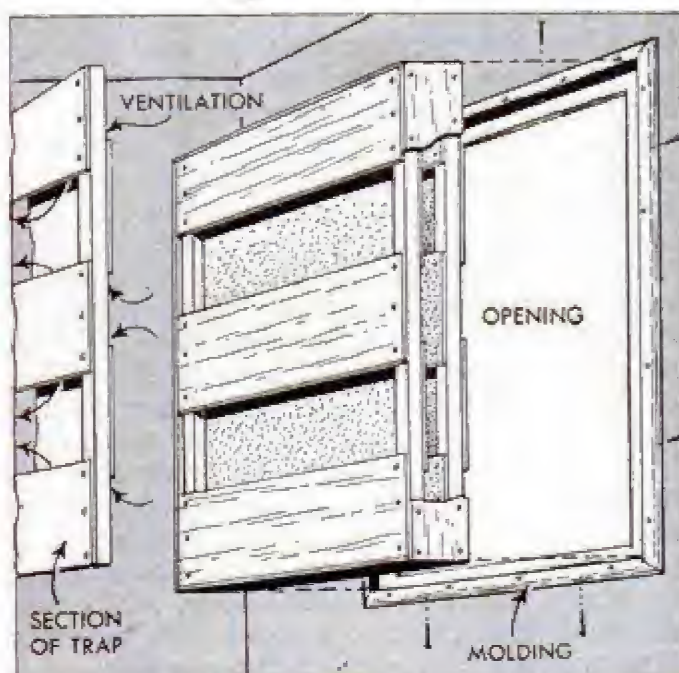
the film holders. To prevent the inconvenience of starting to load the holders and finding that there are only two or three sheets of film left in the box, keep an inventory on the



box cover by marking down the number of sheets remaining each time a portion of the film supply is removed from the box.

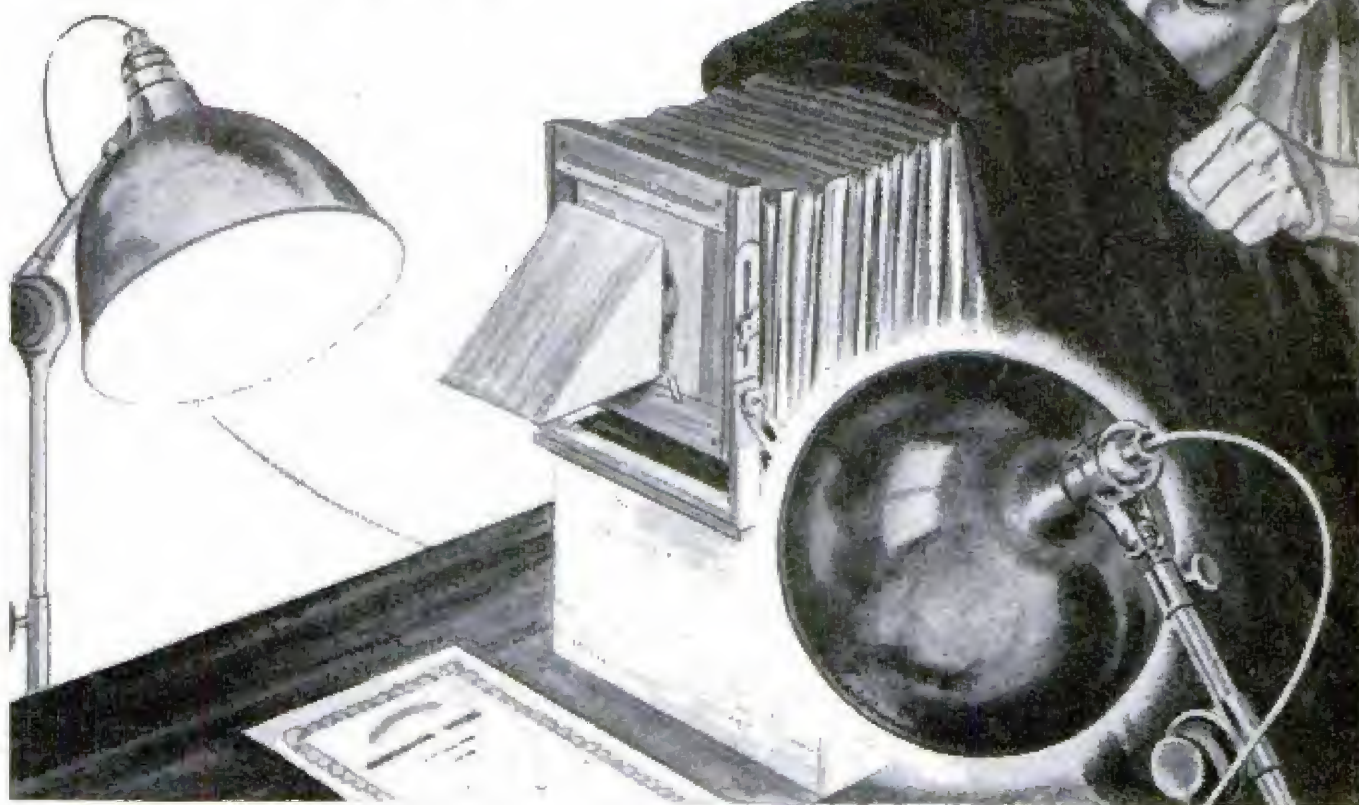
Light Trap for Darkroom Window Permits Passage of Air

One of the major problems confronting the amateur photographer who sets up a basement darkroom is how to ventilate the room and still keep it lightproof. An easy way to do this is to build a light trap, like the one shown, that will fit an open window or an opening cut in an inside wall or door. The trap consists of two baffle sections held apart by wooden side members. The baffles are staggered so that light will not pass through them even though they are separated sufficiently to allow passage of air. Plywood, hardboard or cardboard can be used for the baffles which should be painted flat black to prevent any light reflection. If possible, mount one light trap near the floor of the darkroom and another near the ceiling. This will provide excellent ventilation, especially if a fan is used to help circulate the air.



ADAPT YOUR CAMERA

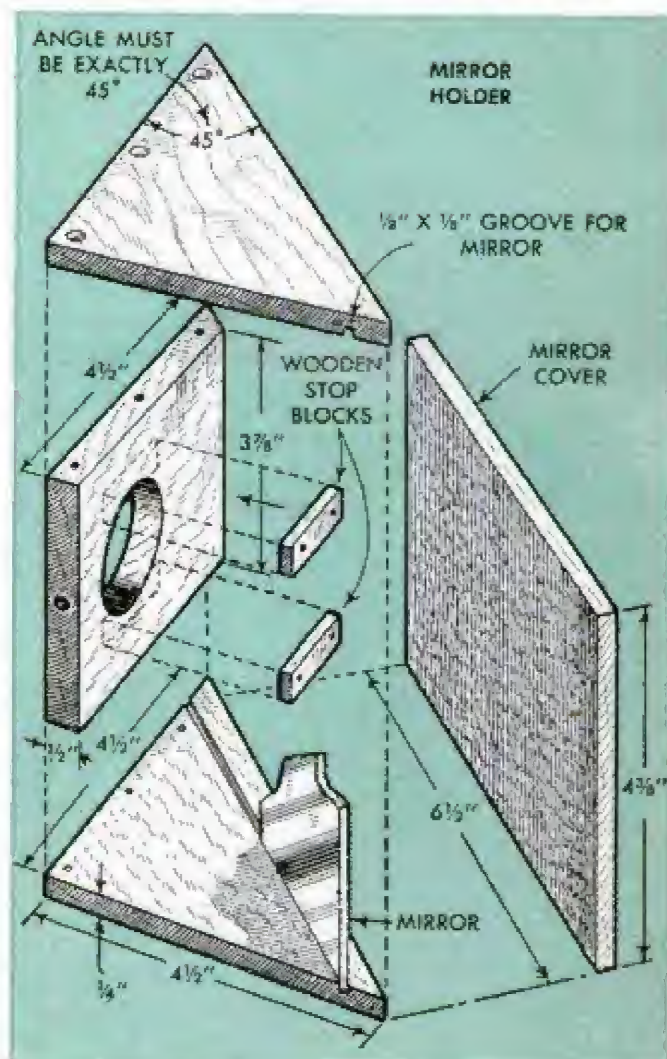
to copy work



By Roland Wolfe

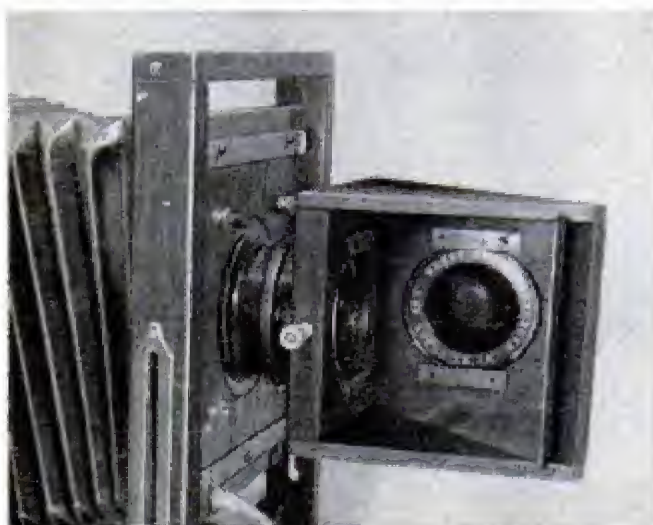
BY FITTING the lens of your camera with what is known to the trade as a "first surface" mirror you can make photocopies—'stats for short—of such original subjects as manuscript pages, letters, business and legal forms, line drawings and any similar printed matter. The purpose of the mirror is to reverse the image of the subject before it is recorded on the sensitized copy paper so that the 'stat reads correctly from left to right. The process simply reverses the black-and-white tone values of the original, making the print appear like a negative, as you can see from the several examples shown at the bottom of the following page.

An ordinary mirror, silvered on the back, cannot be used, as it produces double images and considerable distortion. The first-surface mirror is silvered on the face, or front, of the glass and serves the same purpose in photocopy work as a prism. The mirror is held in front of the lens at a 45-deg. angle by means of a special holder made as detailed at the right. Reflected light from the subject is deflected by the mirror into the camera lens at an angle of 90 deg. For this reason, the copy must be placed in a plane at right angles to the camera lens, either on a table top directly

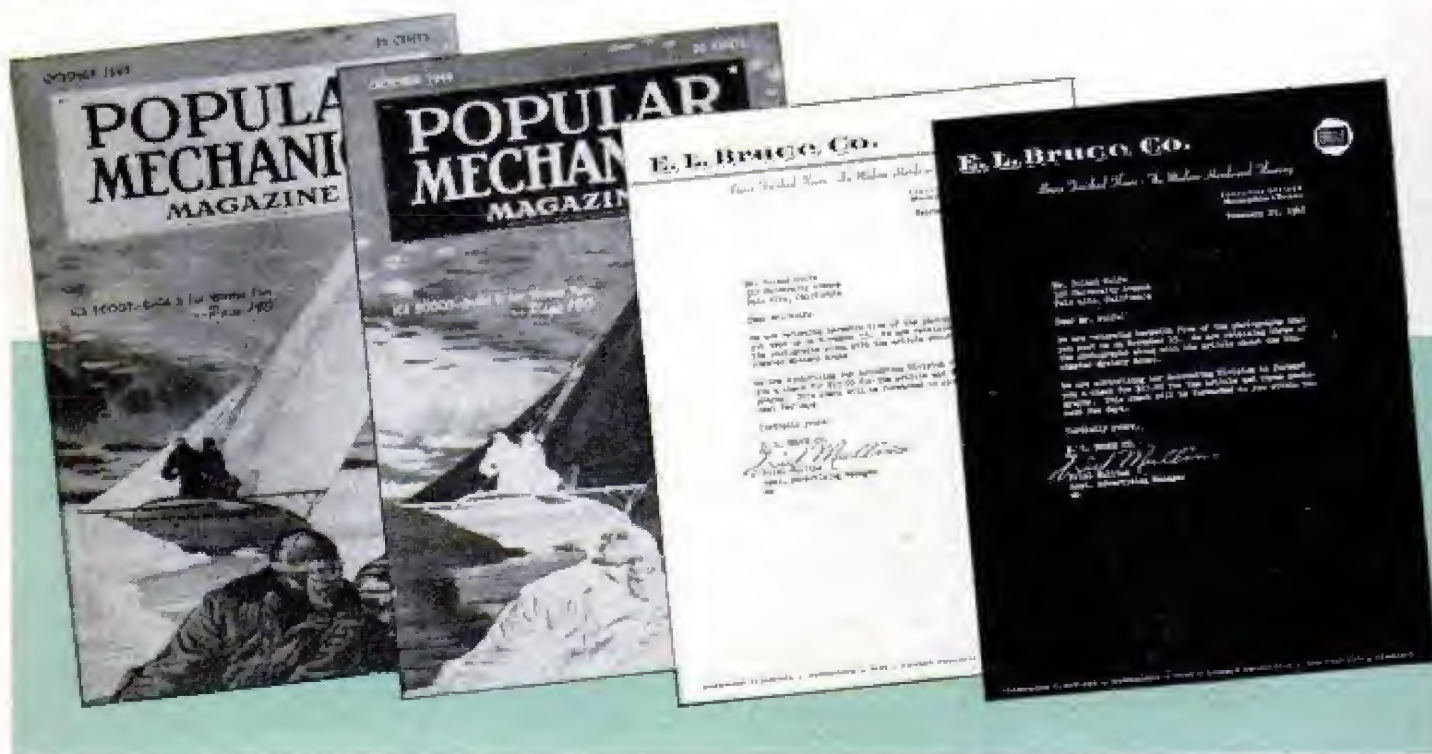




The mirror holder completed with the mirror being inserted in the grooves cut into the sides. Thin felt is glued to the edges of the lens opening to prevent marring lens barrel. Note locking thumbscrew



Above, holder in position on lens. Here it is turned for photographing subject on an easel. Below, samples of negative prints produced by the one-step process. First and third from the left are originals



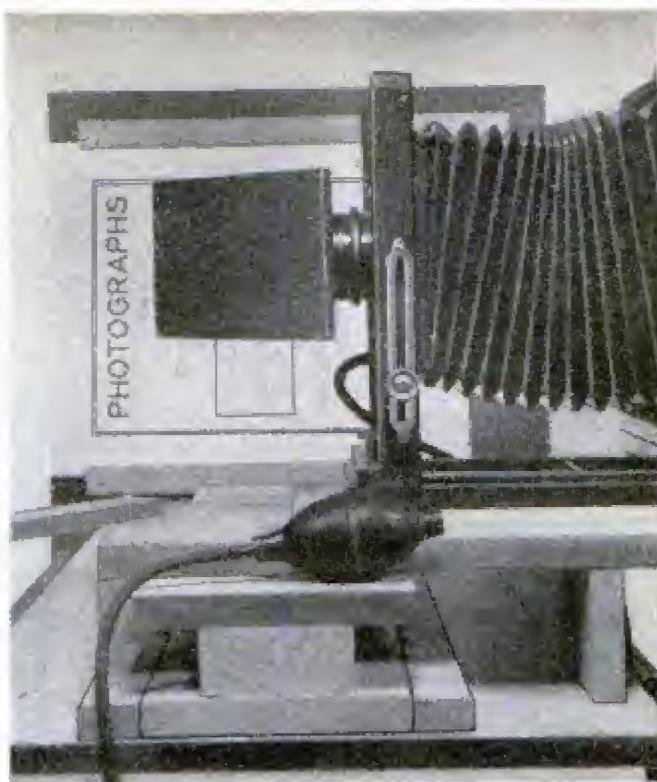
below the camera or on an easel at one side. Although most cameras taking the larger film sizes will serve the purpose, a view camera is best, as this type permits making all focusing adjustments from the back, thus making it unnecessary to move the copy in or out as the lens board and bellows are moved.

The mirror holder, detailed on the preceding page and pictured at the left, can be made either of hardwood or plywood. Care must be taken in its construction and assembly, as it is important that the mirror be supported at an angle of exactly 45 deg. with the axis of the lens. As dimensioned, the holder takes a mirror measuring 4 x 5 in. Before boring the hole for the lens, measure the lens barrel and make allowance for a thin strip of felt to be glued to the edges of the hole after boring. This will protect the lens barrel from scratches. It is necessary that the opening be of the correct size so that it fits the lens barrel tightly after the felt has been glued in place. Note that a locking screw is pictured at the left. Although not essential, this can be added if desired. Use an ordinary thumbscrew and simply bore an undersized hole in the wood so that when the screw is turned into the hole it will cut its own threads. Glue a disk of felt to the end of the screw so that it does not mar the lens when tightened. Finish the inside of the holder with a flat-black paint of the type supplied for photographic equipment.

Although a rigid tripod of the adjustable type can be used for certain types of work, it is seldom satisfactory for general use owing to the 90-deg. angle of light travel from the subject to the camera lens. For occasional copy work it will suffice to place

the camera on a box and then raise it to the required position by blocking up either the camera or the box. It is necessary that both the camera and the table top be leveled in two directions as otherwise it is difficult to bring all parts of the flat copy into sharp focus without some distortion. On the other hand, if you plan to do considerable copy work, it will pay to make the simple copying stand pictured at the right. Here the camera is located in a stationary position at right angles to an easel, which is movable along an improvised track. Both methods have certain advantages and the individual must decide which best suits his purpose.

Where only a limited number of photocopies are made at a time, ordinary cut-film holders may be used for holding the special copy paper. Otherwise, it is best to purchase or build a special camera back to accommodate copy paper in rolls. It should be remembered that one-step copy work eliminates the usual method of negative-positive printing and gives you a reverse print which is suitable for record files at a very low cost per print, as elimination of the film negative cuts both cost and time. If you wish to go one step further, it is possible to rephotograph the negative print and produce a positive print. Since photocopy paper is available with



Here the subject is mounted on a movable easel with the camera placed at right angles to the easel track

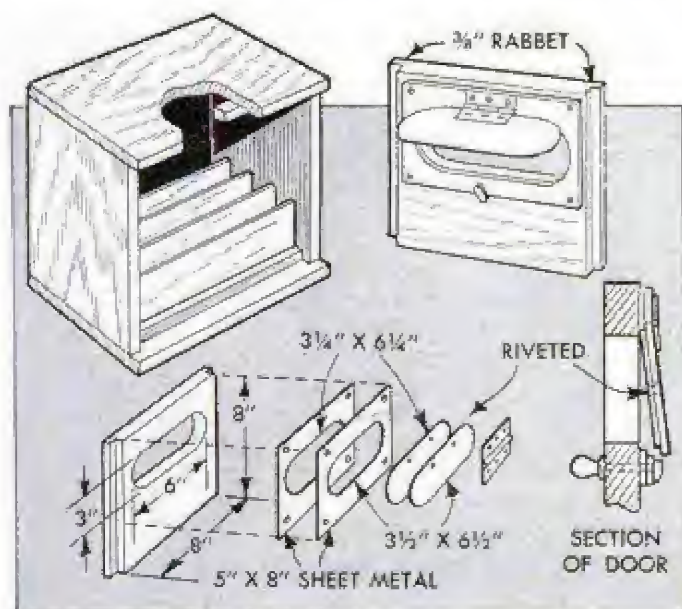
both orthochromatic and panchromatic emulsions, the tonal values of the original copy can be reproduced as faithfully as they are with film negatives simply by rephotographing the negative print.

Wooden "Safe" for Photo Paper Has Self-Closing Door

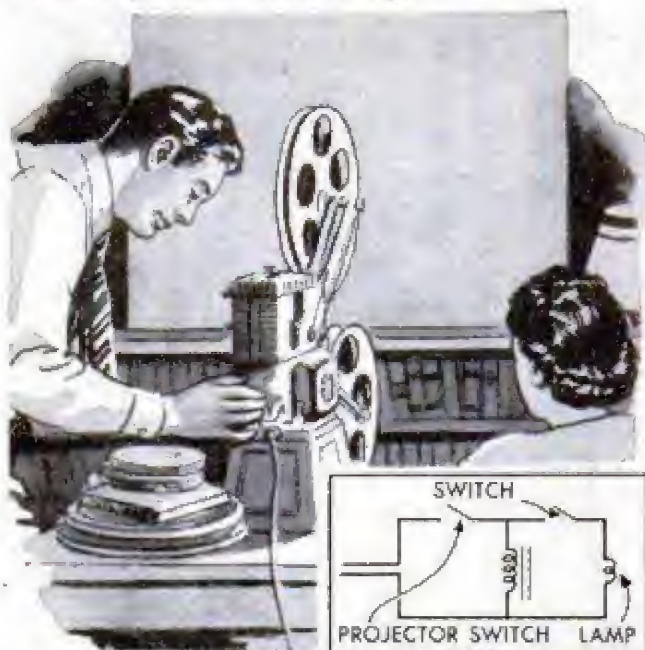
There's no need to worry about accidentally exposing your supply of photo paper when the darkroom light is turned on or the door is opened if the paper is stored in this lightproof paper safe. Although the paper is kept right at your finger tips, it is always protected from light, as the front of the cabinet is fitted with a spring-hinged door which closes tightly after each sheet has been removed. The door swings up-

ward and out of the way when the hand is inserted. A turn button installed directly beneath the door provides a safety lock to keep the door from being opened accidentally. If made to the dimensions given, the cabinet is suitable for sheets up to 4 x 5 in. but, of course, it can be made considerably larger if desired. The cabinet itself is of simple box construction, the parts being carefully fitted and joined with glue and nails so that the cabinet is absolutely lightproof. The slotted panel which contains the spring-hinged door is rabbeted on two sides to fit snugly into the front of the cabinet, and the sheet-metal doorframe is screwed to the inside of the front panel so that it is centered over the 3 x 6-in. slot. A two-piece door, carefully cut to fit the stepped edges of the frame, is riveted together and the rivets are filed flush on both sides. After the door has been riveted to one leaf of the spring hinge, the other leaf is fastened to the doorframe over the center of the opening. The spring on the hinge should be just strong enough to close the door tightly when the hand is removed from the opening. Punch or file a reference mark on the safety-lock knob to indicate when the door is locked.

James W. Thetford, Philadelphia, Pa.



Switch Added to Movie Projector Prolongs Life of Lamp



If your movie projector is equipped with only one switch which turns on motor, blower and lamp, you can obtain longer life from the lamp by fitting the projector with an independent switch for turning off the lamp while rewinding the film. Simply wire a toggle switch into the lamp circuit as shown in the diagram, and drill a hole through the projector base to permit mounting the switch at a convenient spot,

preferably directly above or below the present switch. After installing the lamp switch, check the circuit to be sure that the blower operates when the lamp is turned on.—J. T. Gataldo, Brooklyn, N. Y.

Adhesive Labels for Transparencies

Adhesive labels of the type which require no moistening are just the thing for identifying color transparencies. The labels adhere readily to



the acetate sleeves or cardboard mounts of the transparencies and yet can be removed without leaving marks. These labels are obtainable in most stationery stores and may be purchased in convenient roll form for use with a typewriter.

Tape Guards Box-Camera Shutter

When the film in a box camera has been only partially used and you wish to save the rest of the roll until a later date, use a piece of cellulose tape to prevent accidental tripping of the shutter. Place the tape over the trigger slot so the trigger cannot be moved and simply remove the tape when you again want to use the camera.—Jackson Pratt, San Jose, Calif.

Books That Every Home Craftsman Needs

With the arrival of cool autumn days, every home craftsman and would-be craftsman is thinking about getting his workshop ready for the winter when he plans to do all the work that he put off last summer. Also, it's time to think of that near teen-age son in your family. There is no better way to keep him busy and teach him to concentrate and be neat and careful in all of his work than to start him out in his own home workshop. Besides, he can pick up some spending money by making and selling items to his friends. Training obtained in this kind of work will be invaluable to him in later years when he goes out into the world on his own.

Popular Mechanics book "POWER TOOLS AND HOW TO USE THEM" by W. Clyde Lammey, who is a recognized authority on the use of small power tools, will be invaluable to any craftsman, young or old. It covers workshop layout, workbenches and tool storage as well as basic woodworking joints, moldings, mitered work, jointing, turning and drilling in addition to sanding, shaping and mortising. You will find also various woodworking projects that tie in the use of power tools in construction.

Metalworking is covered, too. Here you

will find the fundamentals of lathe work, measuring with rules, calipers and micrometers, grind finishes, milling, etc. Also included is information on how to run milling cuts, cut threads and operate a drill press. Publication date, Oct. 15; price \$2.50.

Popular Mechanics book entitled "100 BEAUTIFUL PIECES OF FURNITURE YOU CAN BUILD" will solve the problem of every craftsman who wants to make furniture of which he and his family can be proud. The book shows furniture for every room in your home, either as occasional pieces or in complete suites, such as a living-room suite, a dining-room suite or a suite for a bedroom. In fact, an owner of a new home can furnish it completely with furniture described in this book, in either modern or period style. Every piece is pictured and completely detailed in addition to having a thorough text that tells how to build it step by step. There are 48 pages in full color that enable you to view the furniture in its natural beauty. Most of the suites were designed exclusively for *Popular Mechanics* by John Bergen who styled them to be made easily with tools owned by the average home craftsman. Publication date, Oct. 15; price \$3.00.

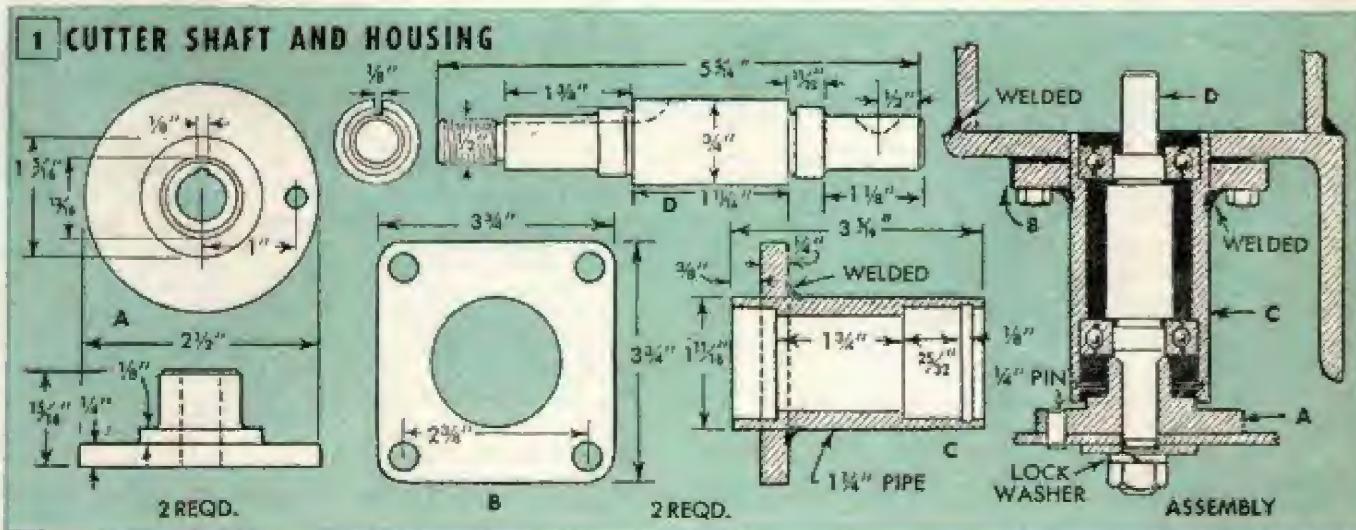
Both books are available from *Popular Mechanics* Book Dept., 200 E. Ontario St., Chicago 11

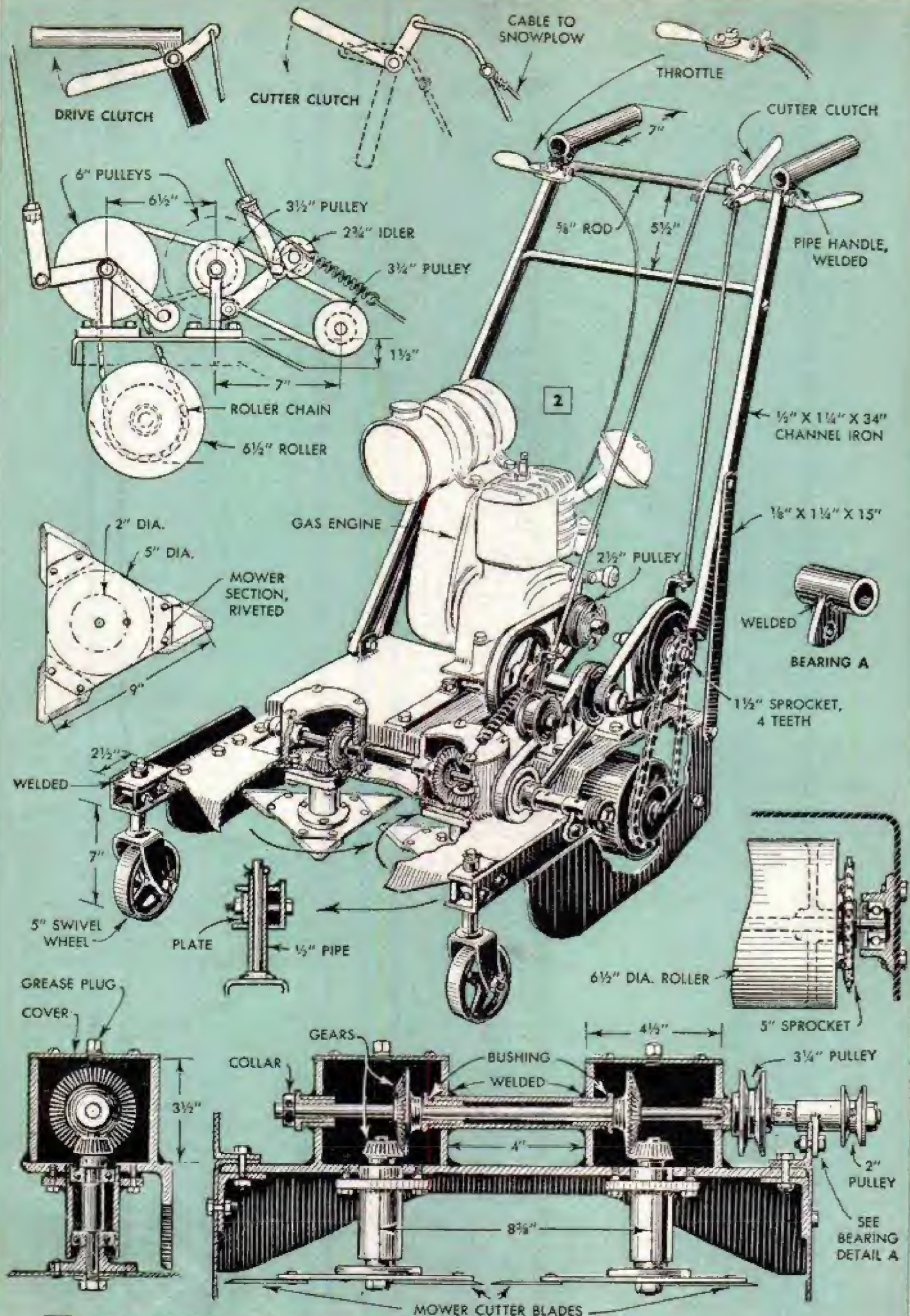


NOT LIKE most lawn mowers that go into retirement during winter, this double-duty machine earns its keep the year 'round. Featuring two intersecting rotary blades, it serves as an efficient power mower in summer, and a scoop attachment converts it in winter to an excellent rotary snowplow. Powered by a 1½-hp. Briggs and Stratton gasoline engine, the machine

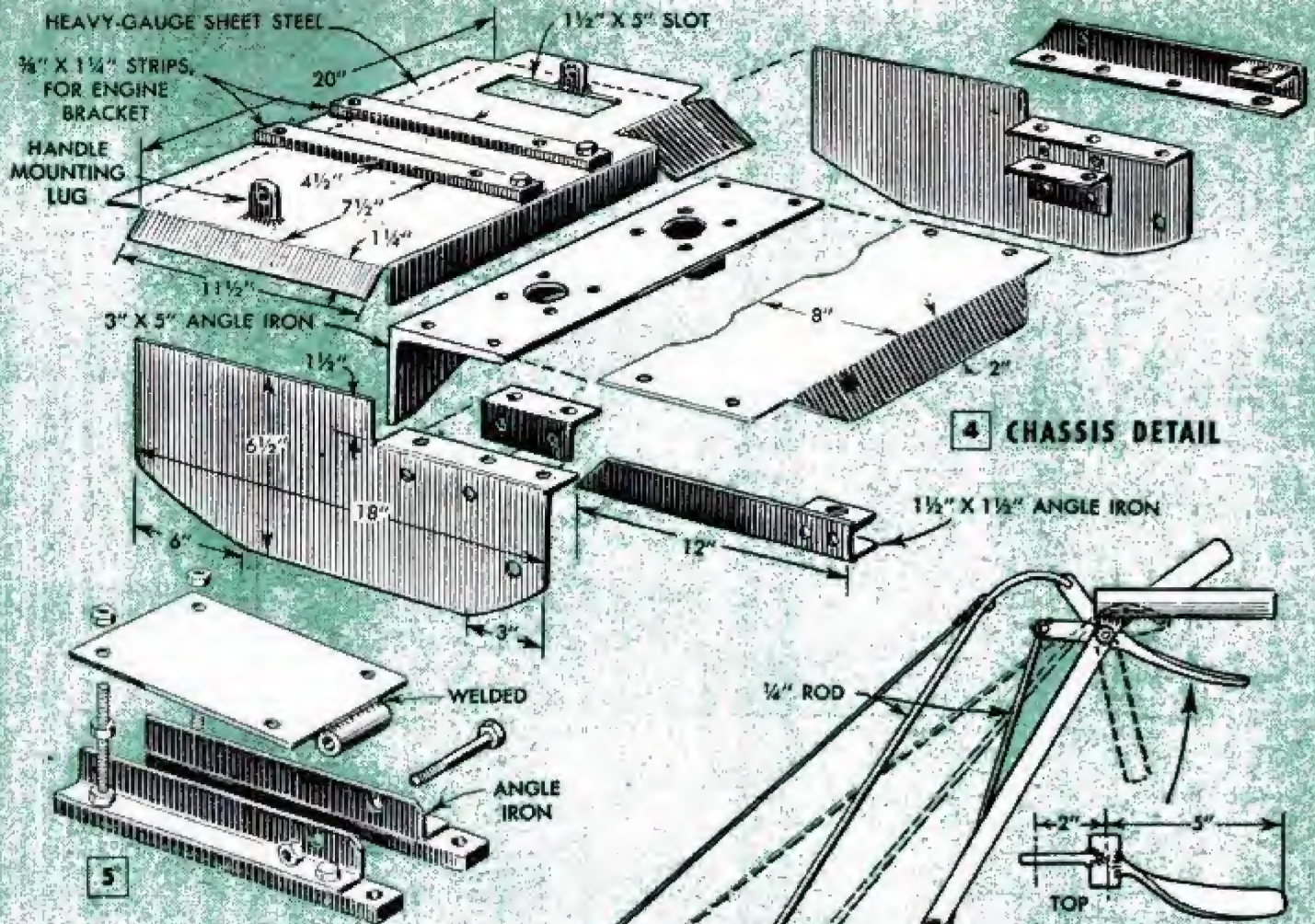
is self-propelled by a chain-belted drum. Power transmission to the mower and the snowplow is provided by a V-belt drive.

Designed and built by L. O. Hansen of Waterloo, Iowa, the original mower pictured above was assembled from odd parts, welded together. The cutaway drawing, Fig. 2, gives a general idea of the arrangement of the V-belt drive, and also shows how

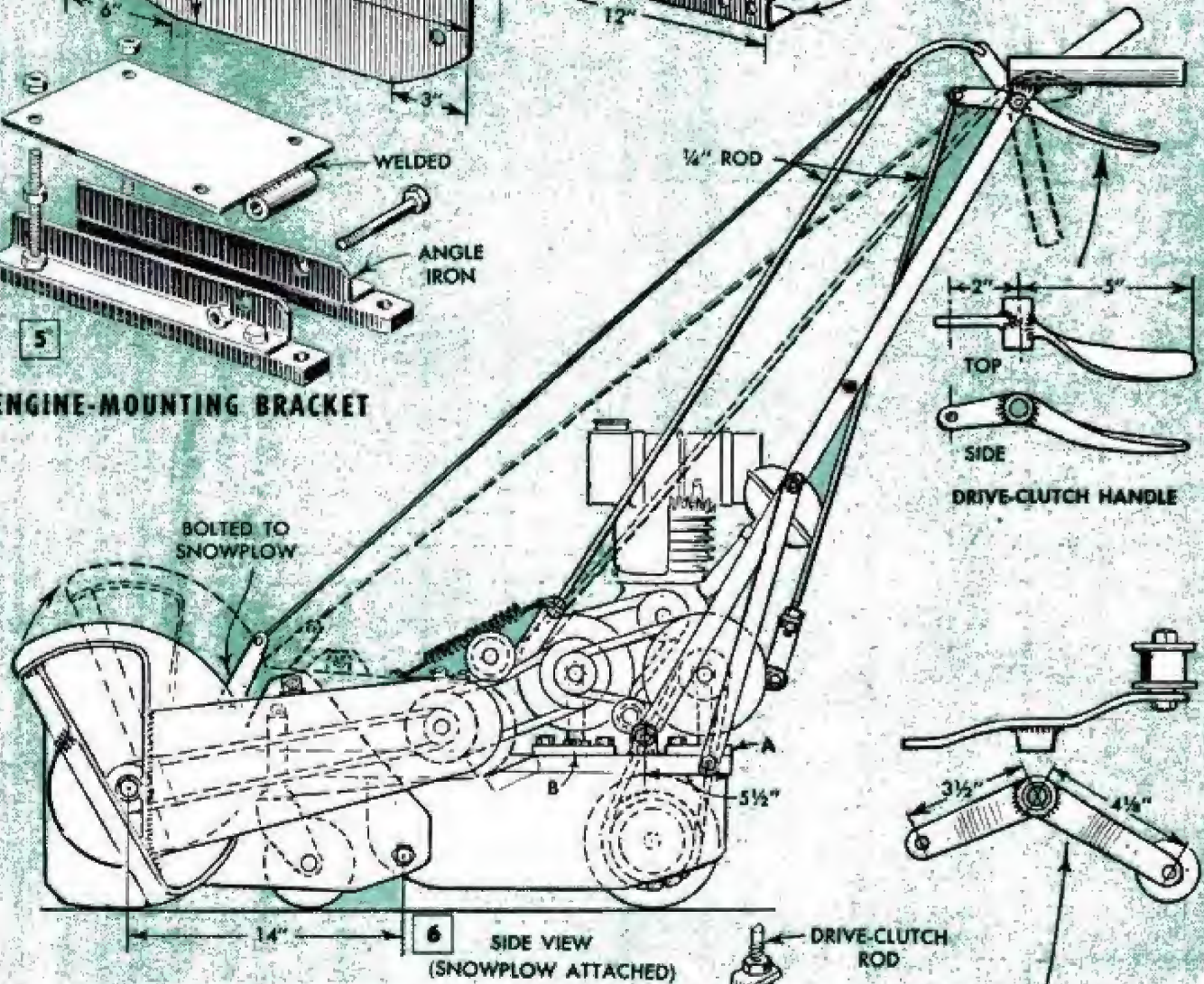




3 SECTION THROUGH GEAR HOUSING



5 ENGINE-MOUNTING BRACKET



PLOW IDLER ROD

TENSION SPRING

WELDED

$\frac{1}{4}$ " X 3" X 4"

$\frac{1}{4}$ " PLATE

BRACKET B

COLLAR

7 BRACKET DETAILS

$\frac{5}{8}$ " X $\frac{7}{8}$ " X 3 $\frac{1}{2}$ "

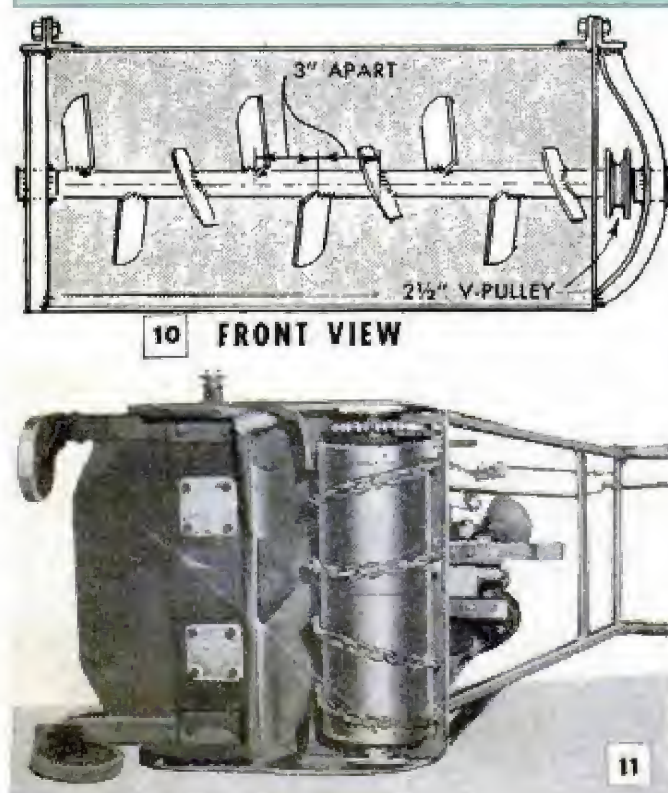
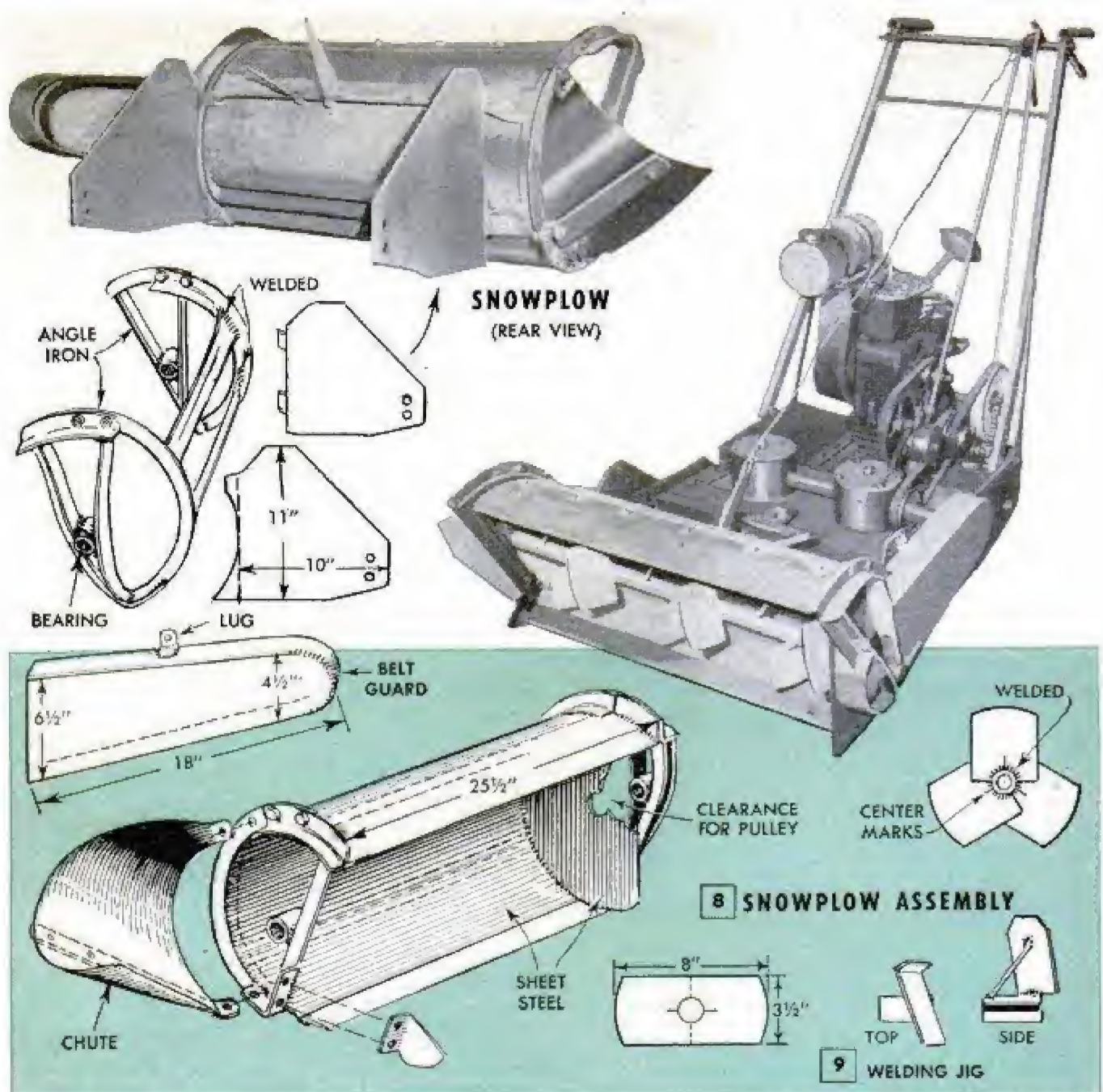
2 $\frac{1}{4}$ " IDLER ROLLER

DRIVE-CLUTCH ROD

OIL CUP

BRACKET A

$\frac{1}{4}$ " X 3" X 3"



bevel gears are used to spin the twin mower blades. The original machine used an old golf-green roller to provide the driving drum that propels the mower. If such a roller cannot be obtained, you can substitute several wide flat-belt pulleys for this part. A 5-in., 15-tooth sprocket is welded to one end of the drum and the axle is housed at each end in ball bearings held in special castings machined for a press fit. Sleeves which form bearings for the swivel casters are adjustable to regulate the cut.

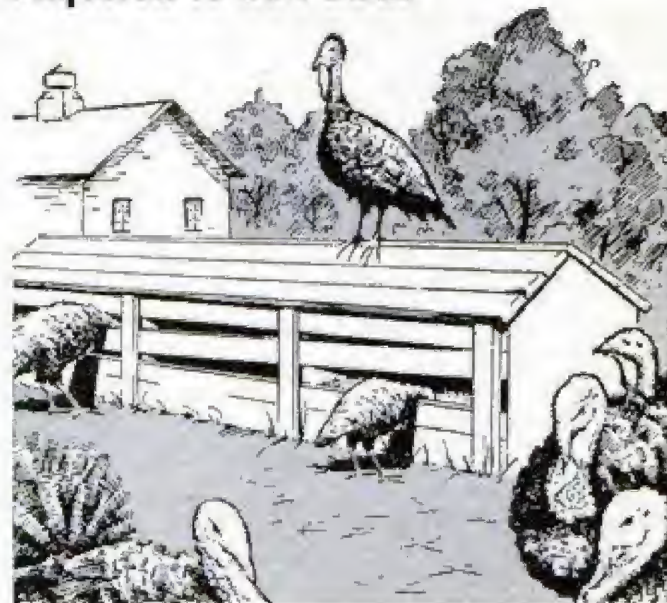
A study of Figs. 1 and 3 will acquaint you with the parts needed and assembly of the twin pipe sleeves that carry the shafts for the blades. Notice in Fig. 3 that each set of bevel gears is installed in a circular gear-box. The latter are fitted with bushings and coupled together with a length of pipe through which a $\frac{5}{8}$ -in. drive shaft is inserted. The outboard end of the shaft carries a 2-in. pulley which operates the snowplow. Each vertical shaft unit, Fig. 1, is

held in place with four, short cap screws, thus permitting both units to be removed temporarily when the mower is changed over to a snowplow. Two ball bearings seated in the ends of each unit result in a free-running shaft. The matched bevel gears provide a 3-to-1 speed ratio, a 16 pitch, 3-in. P.D., 48-tooth gear being used on the drive shaft and a 1-in., 16-tooth pinion being keyed to the blade shaft.

The side-view drawing in Fig. 6 shows where pulley brackets A and B are mounted, and also illustrates, as indicated by the dotted lines, how the snowplow attachment is automatically raised when power to the snowplow is cut off. Traction, as well as power to the mower blades and snowplow, is controlled by slippage of the V-belt drive. As shown in the construction details in Fig. 7, idler pulleys are used to take up slack in the belts. Assembly of the chassis, Fig. 4, centers around a heavy piece of angle iron which forms the backbone to which the rest of the parts are welded and bolted. The pipe gearboxes for the bevel gears are tack-welded to this angle iron and holes are drilled and tapped in it for attaching the blade-shaft assemblies. The two triangular mower blades consist of $\frac{1}{8}$ -in.-thick steel plates equipped with three razor-sharp mower sections riveted to the ends. Besides being accurately centered and drilled for mounting, each blade is drilled for a $\frac{1}{4}$ -in. locking pin which engages a corresponding hole in the backing plate, part A, Fig. 1. Fig. 5 details the engine mounting bracket.

The snowplow attachment, Fig. 8, is pivoted to the side of the chassis (see Fig. 6) and is fitted with a belt guard. A wire cable, which is connected to the cutter clutch rod, is attached to an upright arm fastened to the snowplow and permits raising the latter to clear obstructions. The plow features a screw impeller which throws the snow to one side through a chute. The screw consists of nine vanes of $\frac{1}{8}$ -in. sheet steel welded to a 1-in. shaft which is machined down at the ends to rotate freely in bushings welded to the ends of the scoop. The vanes are spaced 3 in. apart, Fig. 10, and are welded equidistantly around the shaft as indicated in the detail above Fig. 8. The vanes are welded in place at a 30-deg. pitch and are held at the correct angle by means of a special jig, Fig. 9. The jig consists of a split sleeve tack-welded to a sheet-metal plate. In use, the sleeve fits over the shaft and is moved along it to the point of weld. A vane is simply leaned against the plate which supports it at the proper angle while it is being welded. Fig. 11 shows the mower blades removed and a chain wrapped around the drum to provide traction on ice.

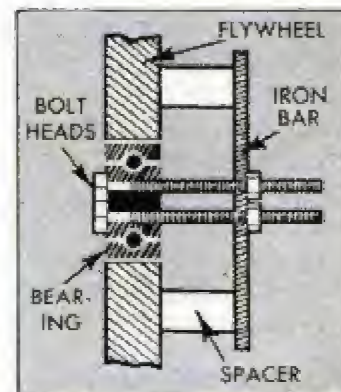
Slat Sides of Turkey Feeder Adjusted to Suit Birds



Varying the position of the slat sides on this turkey feeder permits the height of the feeder to be increased as the birds grow. When the turkeys are small and first put on the range, the slats are lightly nailed near the top so the birds have easy access to the feed. When the turkeys become larger, the slats are lowered, thus raising the height of the opening and increasing the capacity of the feeder. The drawing shows a slat nailed in place diagonally to illustrate both upper and lower positions.

Puller for Flywheel Bearing Improved From Bolts

When it is necessary to remove a flywheel pilot bearing and a puller is not to be had, one can be improvised in a few minutes from two long bolts and an iron bar. The bolts should be of a size which permits the head of one and



the shaft of the other to be passed through the hole in the bearing simultaneously. However, the heads must be large enough so that both of them will not pass through the hole at the same time. After both bolts have been pushed through the bearing, the bolt heads are positioned side by side to engage the edge of the bearing hole. Then the iron bar, which has been drilled for both bolts, is slipped over the threads and a nut is turned on each bolt. A spacer is placed under each end of the bar and the nuts are gradually tightened to pull the bearing from its seat.



PRECISION

With Verniers

brated dial. The movement of the hand is easily read in thousandths or in ten-thousandths of an inch. In this respect, dial gauges differ from all other types of measuring instruments covered in Parts I and II.

Some gauge dials made for specialized work, such as comparative inspection, are fitted with tolerance hands which may be set to indicate plus and minus limits in thousandths or tenths. On other special types designed for a spindle travel up to 1 in., the dial is fitted with a short telltale hand which registers the number of revolutions of the master hand when the spindle is moved. Gauge dials also are regularly calibrated for continuous readings from 0 to 10, 0 to 50, etc., and for balanced, or plus-and-minus readings such as 0-5-0, 0-25-0 and so on, depending on the requirements of the job in hand.

Figs. 28 to 34 inclusive show various applications of the universal type of dial gauge, the complete gauge set being shown in Fig. 32. The set is furnished with contact points A, B and C, Fig. 32, a hole attachment, clamp and tool-post holder. The clamp, tool-post holder and hole attachment permit the instrument to be used on large lathes and planers, milling machines of the vertical and horizontal type and also for certain setup work on shapers. A helpful feature of this particular type of gauge is the adjustable dial. By simply turning the knurled rim, the dial may be moved to bring the zero mark to any point desired in relation to the hand. Usually the circumference of the dial is divided into 100 equal divisions, each representing a movement of the contact point .001 in. One complete revolution of the hand adds up to .1 in. on this particular type of dial. Fig. 28 pictures

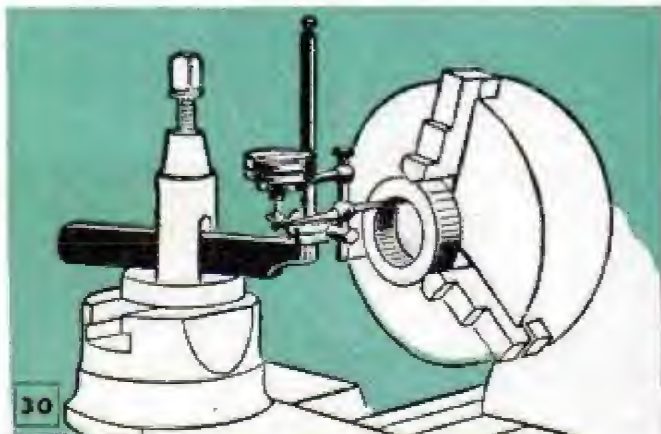
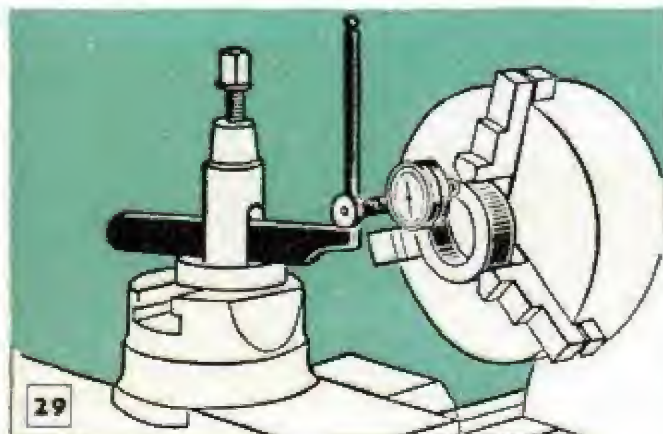
Part III

By W. Clyde Lamme

DIAL INDICATORS, or dial gauges as they are often called, are widely used in industry for checking the accuracy of machine-tool setups and sizes of parts, in the inspection of duplicate parts and in various other gauging operations where precise measurements must be made consistently. Dial gauges look something like watches and the best-grade instruments are made with watchlike precision. Basically, the dial unit consists of a rack-and-pinion mechanism connected to a gear train having ratios capable of translating a slight movement of a spindle to a much greater movement of a hand swinging on a cali-

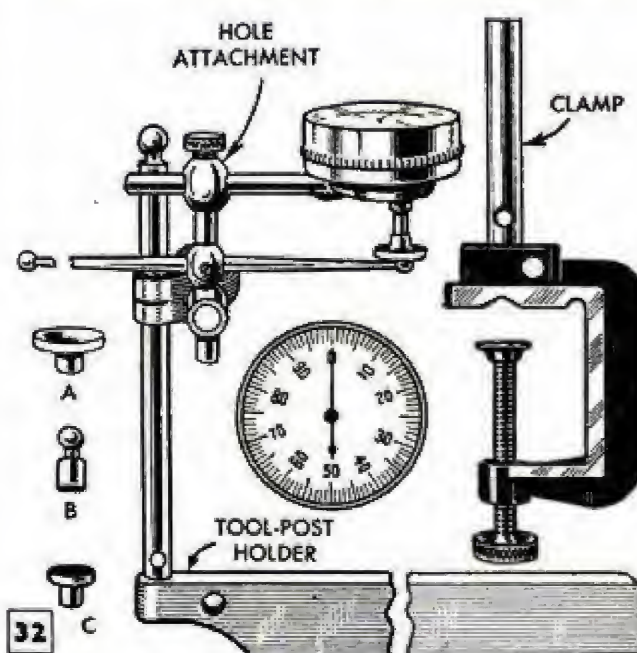
Universal dial gauge set up for direct contact with the work when checking accuracy of facing cut

When checking the accuracy of bores, the hole attachment is used. Contact is made through a pivoted arm



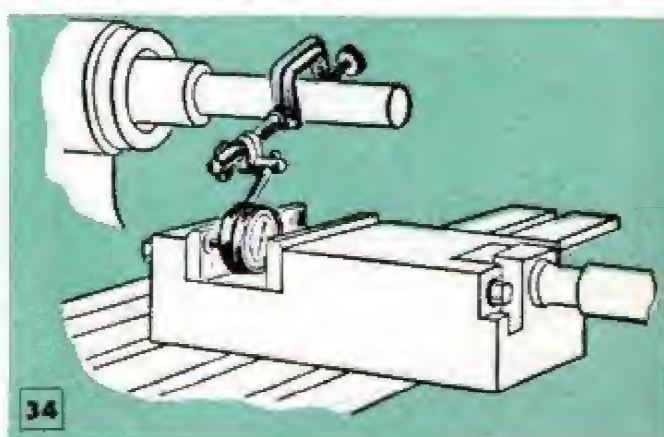
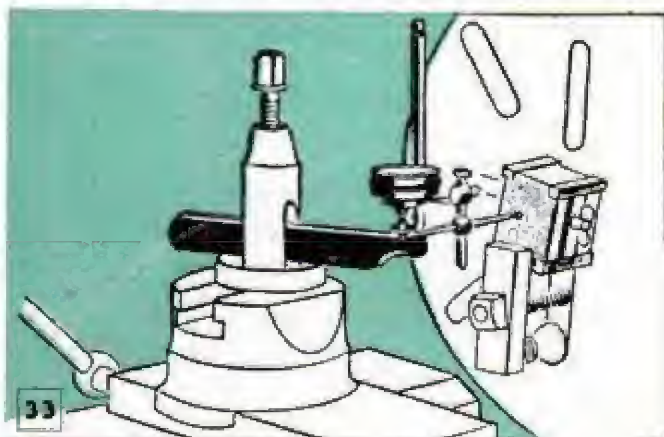
MEASURING and Dial Gauges

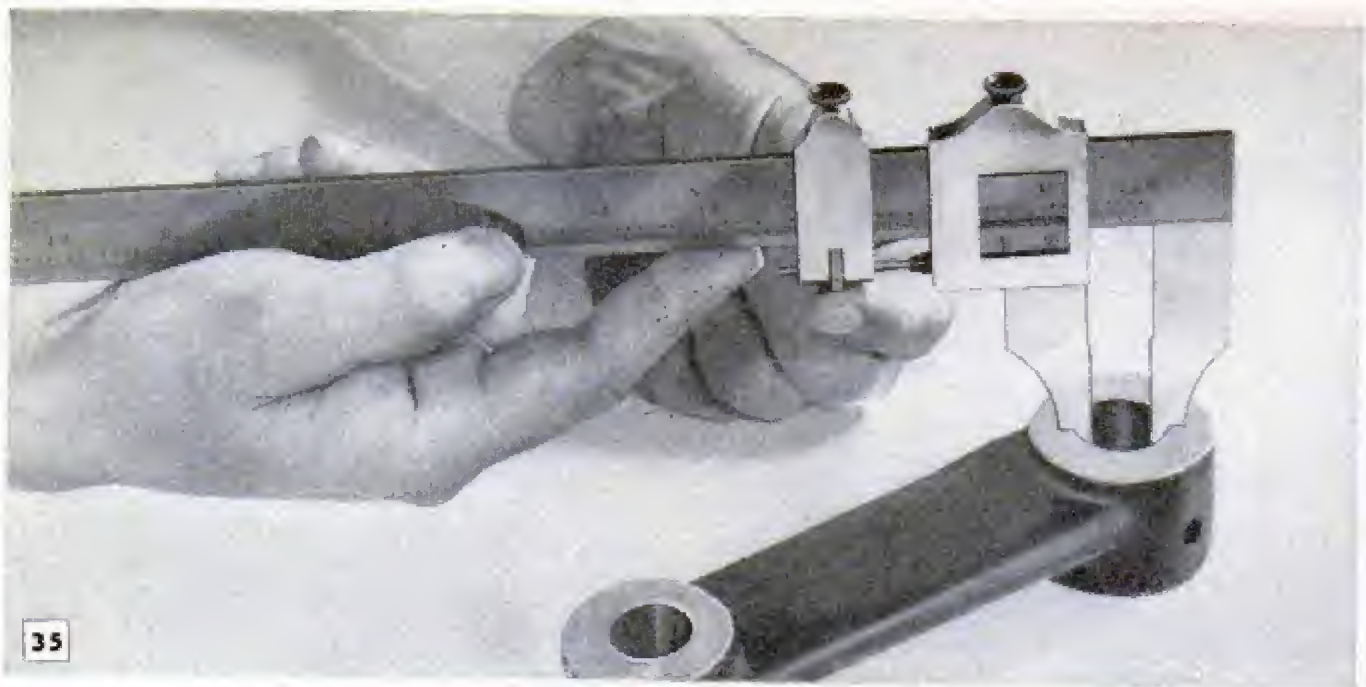
the universal indicator being used to check the runout of a lathe chuck before setting up a small job on which the machine work will be quite exacting. Fig. 29 shows the same instrument set up to check on the accuracy of a facing cut. In Figs. 30 and 33 the instrument is assembled with the hole attachment, Fig. 32. The arm, having two ball-shaped ends, is pivoted below the dial in such a position that one ball end bears on the contact point of the dial spindle when the other end of the pivoted arm contacts the inside of the bore in the work. After the parts are placed in contact and the dial is adjusted to the zero reading, the lathe is turned slowly by hand. Any slight errors in the bore diameter will register on the dial. Setting the ball end of the actuating arm at the outer edge of the bore and running the lathe carriage slowly forward will enable the machinist to detect errors in the bore in the axial plane. In Fig. 33 the hole attachment is used to reach over the blocking on the face-plate, as here it would not be possible to use the dial alone as in Figs. 28 and 29. Figs. 31 and 34 show how the dial is mounted with the special clamp on machine parts for making critical accuracy checks. The inside of the clamp frame is machined to a right angle and the jaw is "veed" so that it may be attached to parts of almost any size or shape within its capacity. Note that when the unit is assembled as in Fig. 32 the movement of the dial is universal. It can be placed in practically any position that the nature of the work requires. When locating the dial to take an important reading, be sure that all binding screws are tightened before running the test. It should be kept in mind that Fig. 32 pictures only one of



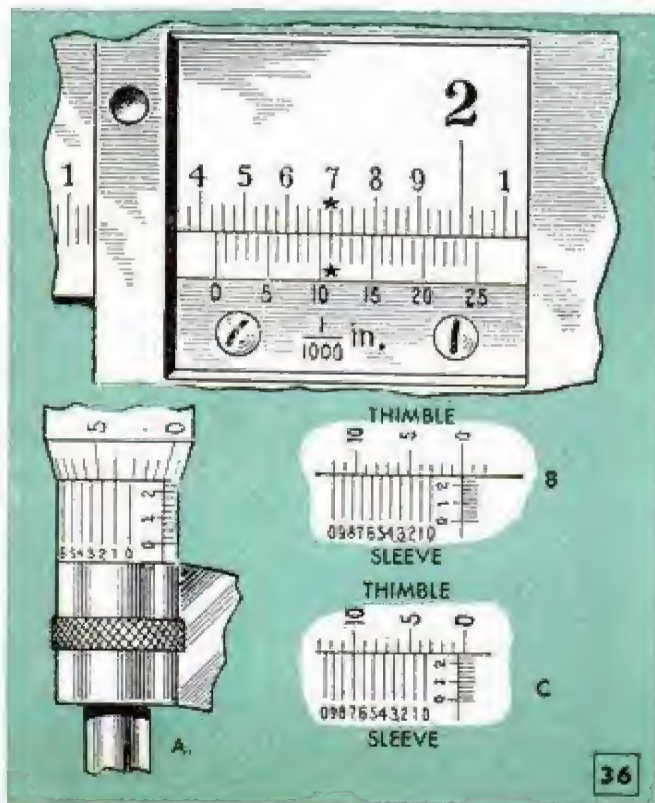
Here the hole attachment gives clearance over face-plate lugs or blocks. The lathe is turned by hand

In this setup, the dial is attached to the special clamp for checking the alignment of machine parts



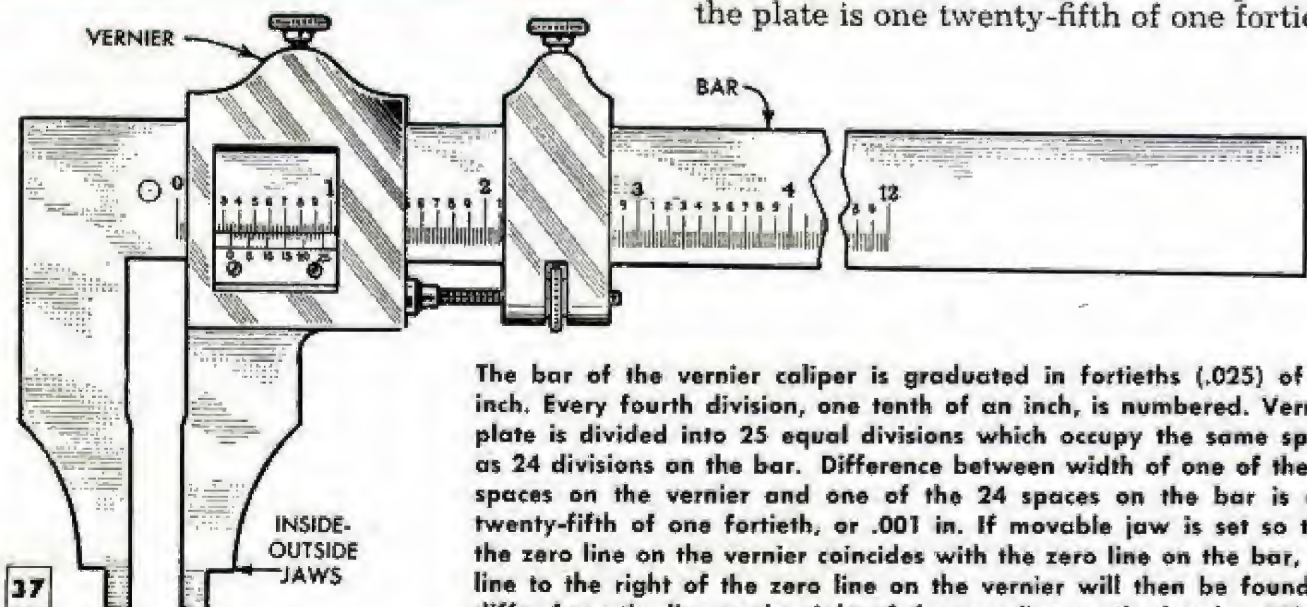


35



the many types of fixtures in which dial gauges are used.

The inside-outside vernier, or vernier caliper, and also the vernier height gauge, are units which, in effect, are simply combinations of steel rules that permit exceedingly accurate measurements. The vernier caliper, Figs. 35 and 37, consists of a graduated steel rule, generally called the bar, on one end of which is a fixed jaw, or contact point. A movable jaw sliding on the bar and controlled by a slow-motion screw, which may be locked at any point along the length of the bar, carries a graduated rule, or plate, arranged so that it may be compared with the fixed scale on the bar. The fixed scale is graduated in fortieths of an inch (.025) and every fourth division representing one tenth of an inch is numbered, Fig. 37 and the upper detail in Fig. 36. The plate (vernier) is graduated into 25 divisions and the space, or total span, of the 25 divisions is equal to 24 divisions on the fixed scale. Thus, each graduated space on the plate is one twenty-fifth of one fortieth



The bar of the vernier caliper is graduated in fortieths (.025) of an inch. Every fourth division, one tenth of an inch, is numbered. Vernier plate is divided into 25 equal divisions which occupy the same space as 24 divisions on the bar. Difference between width of one of the 25 spaces on the vernier and one of the 24 spaces on the bar is one twenty-fifth of one fortieth, or .001 in. If movable jaw is set so that the zero line on the vernier coincides with the zero line on the bar, the line to the right of the zero line on the vernier will then be found to differ from the line to the right of the zero line on the bar by .001 in.

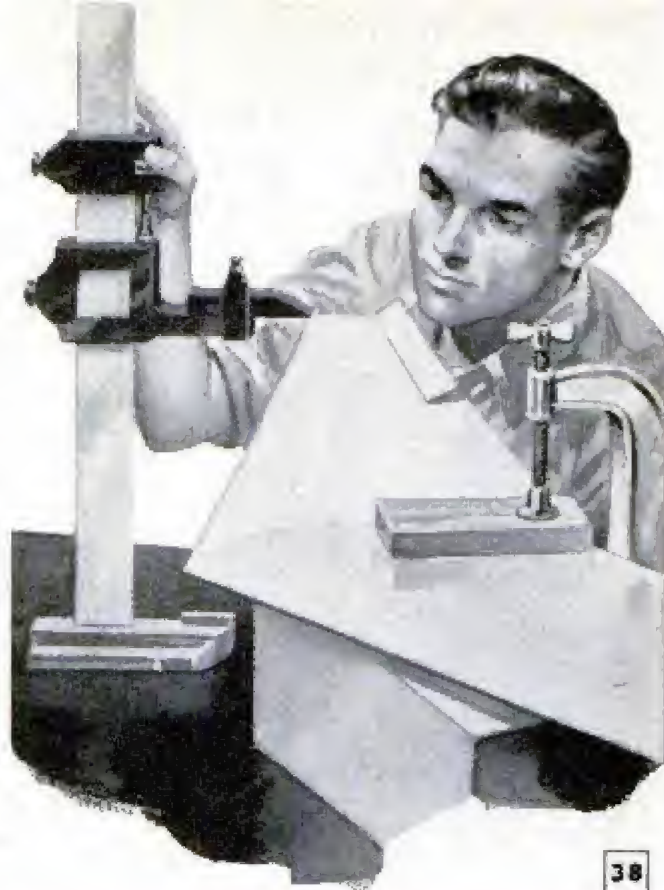
of an inch (.001) less than a corresponding space on the fixed scale. Although this seems a little involved, it will be greatly simplified by remembering that, if the zero marks on the bar and plate are exactly aligned, the first marks to the right on the bar and plate will be .001 in. out of line. The second marks will be .002 in. out, and so on. Now, if the slide is adjusted to bring the first two marks precisely in line, the jaws will have opened .001 in., and, if the slide is moved to bring the fourth pair of marks into line, the jaws will have opened .004 in., and so on.

Once this progression is understood, the principle can be used to read the instrument with the vernier in any position on the bar. For example, looking through the "window" in the movable jaw, as shown in the upper detail in Fig. 36, the vernier has been moved to the right one and four tenths and one fortieth inches, or 1.425 in., as shown on the bar. It also will be noted that the eleventh line on the vernier coincides with a line, indicated by stars, on the bar. Thus eleven thousandths of an inch must be added to the reading on the bar, making the total reading 1.425 plus .011 in., or 1.436 in. It should be noted in the upper detail in Fig. 36 that the offsets and spacings of the lines on the plate and bar have been exaggerated somewhat. Essentially the same principle applies to the vernier height gauge, Figs. 38 and 39. This instrument is designed for measuring or laying off vertical distances where a high degree of accuracy is required.

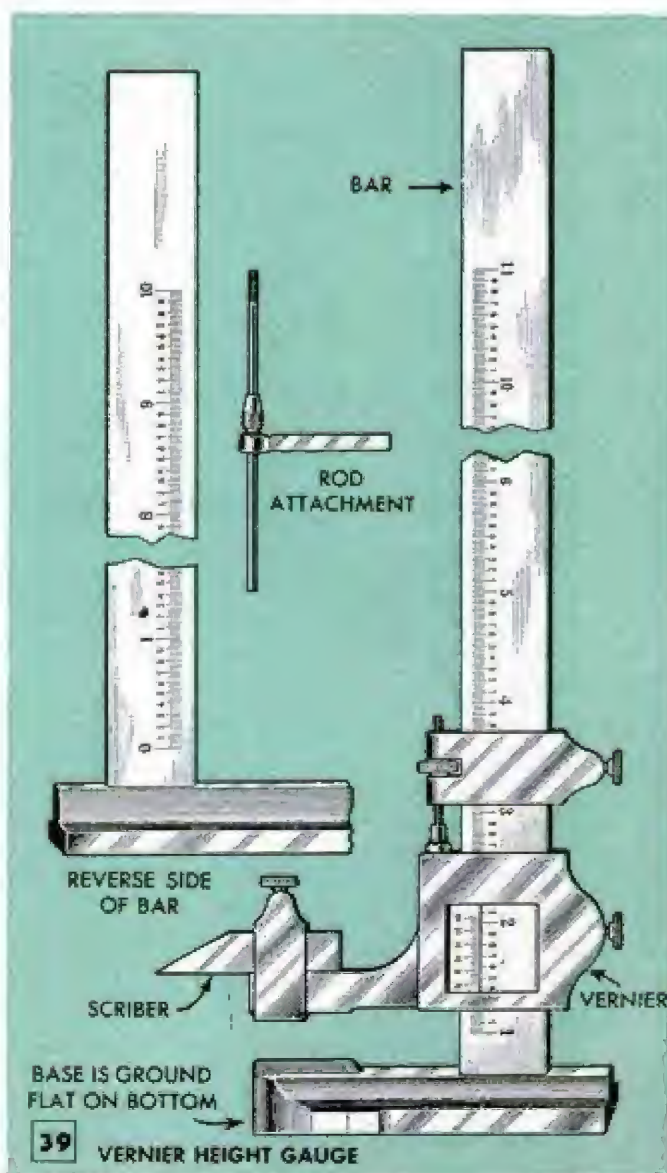
Details A, B and C in Fig. 36 show sample readings of a vernier micrometer graduated to read in ten-thousandths. Otherwise the instrument is the same as the ordinary mike graduated to read in thousandths. The difference is that on the vernier mike there are ten divisions marked on the sleeve occupying the same space as nine divisions on the edge of the thimble. The thimble is graduated to read in thousandths, thus one tenth of a division would be one ten-thousandth of an inch. To make the reading, first read to thousandths as with the regular mike, then note which of the lines on the sleeve coincides with a line on the thimble. In Fig. 36, B, a zero line on the thimble coincides with an axial line on the sleeve and the vernier zero on the sleeve coincides with a line on the thimble. The reading would be .2500 in. But in detail C it will be noted that the zero line on the thimble indicates a value greater than .2500 in. Note that the seventh vernier line on the sleeve coincides with a line on the thimble, making the total reading .2507 in. Mikes graduated to read in tenths are now widely used by machinists.

(The End)

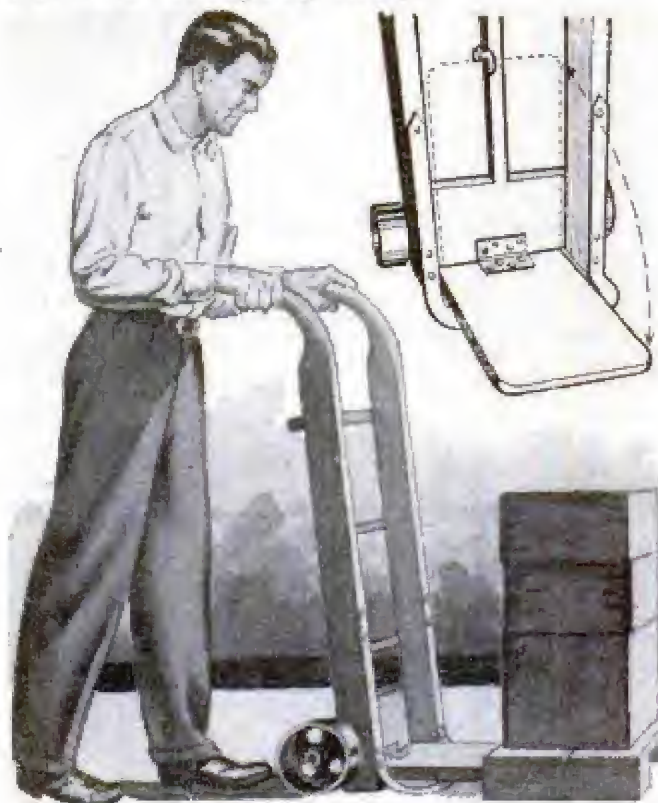
[Certain technical information courtesy L. S. Starrett Co.]



38

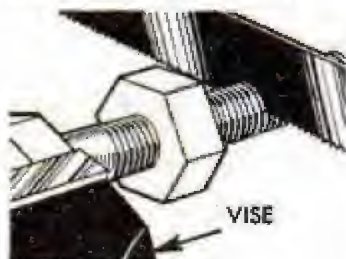


Extension on Hand Truck Permits Carrying Skids



Because it is easy to handle in narrow aisles, a two-wheel hand truck is often preferred to the larger platform truck even though the size of its load is limited. Fitting the nose of the hand truck with a hinged wooden extension will permit picking up skids which will handle a more sizable load than the nose plate itself. When not in use, the extension is hooked in the upright position. The skids can be made from waste lumber, 16 x 16 in. being a convenient size, and should be high enough to allow the extension to slide under them easily.—J. A. Richards, Saco, Me.

Renewing Bolt Threads After Cutting



When a bolt or machine screw must be cut off either with a hacksaw or snips, the threads are likely to be damaged at the point of cut.

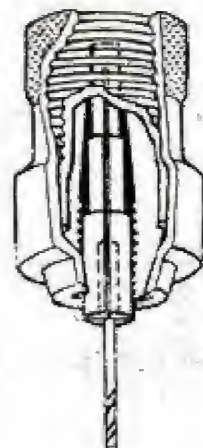
To renew the threads, turn a nut well onto the bolt before cutting and, after the bolt has been severed, back off the nut. If the bolt has been snipped with cutters instead of sawed, it is best to round the end on a grinder before backing off the nut.

W. H. McClay, Pasadena, Calif.

☐ A hot-water bottle filled with scalding water will often thaw a frozen car-door lock when other methods fail.

Brace Chuck Fitted With Adapter Holds Twist Drills Securely

Frequently it is advantageous to drive small twist drills with a hand brace, but most hand-brace chucks will not hold small straight-shank drills securely. Adapters for the most-used drill sizes are easily made from short lengths of steel rod. Square one end of each length of rod and drill a hole in the squared end to a depth of about $\frac{3}{4}$ in. with the same drill which is to be used in the adapter. Be sure that the hole is centered. Then slot the rod at right angles with a hacksaw to a depth of roughly $1\frac{1}{2}$ in. The slots form four jaws which close on the drill shank in the same manner as the jaws of a collet. To use, insert the adapter in the hand-brace

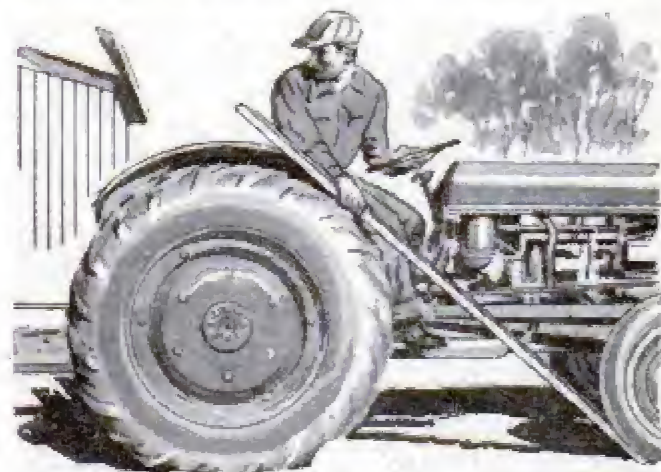


chuck, insert the drill and tighten the chuck. In some hand-brace chucks the jaws are tapered, or are pivoted at the inner ends. In this case, it will be necessary to shoulder the adapters as in the detail so that the chuck jaws will close fully.

W. F. Schaphorst, Newark, N. J.

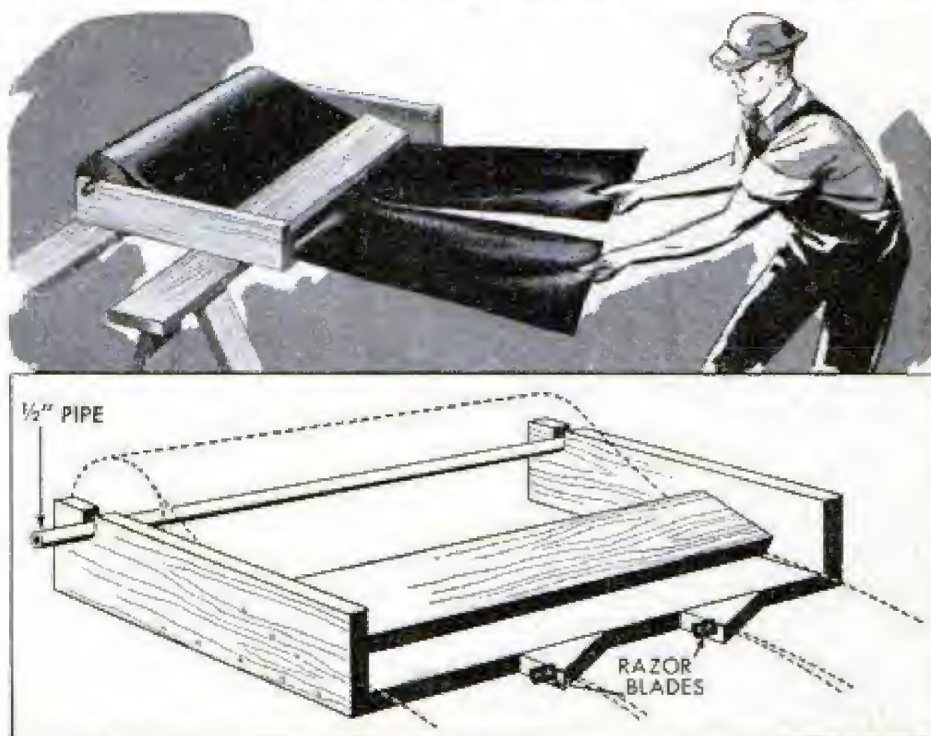
Board Wedged Between Wheels To Block Tractor for Belt Work

Four-wheeled tractors having rear-mounted belt pulleys are quickly blocked for belt work by placing a board behind the front wheel and over the rear wheel as illustrated. In some cases, it may be necessary to use two boards, placing one back of each front wheel to prevent the tractor from creeping sidewise when driving a long belt. The boards are easily placed in position by the operator as the belt is tightened.—John Evritt, Vandalia, Ohio.



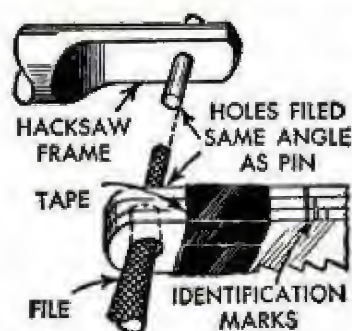
Handy Cutter Speeds Trimming Building Paper

When it is necessary to cut building paper into narrow strips, one carpenter uses this simple cutter to rip the paper to size quickly. Razor blades fastened at an angle provide the cutting edges, and the roll of paper rotates on a length of $\frac{1}{2}$ -in. pipe. Note that the paper is pulled under a guide board so that it is held tightly against the blades, the latter being screwed to cleats which are nailed or screwed to the front edge of the cutter frame. One, two or more blades may be used and spaced to suit the desired widths. — Hi Sibley, Nuevo, Calif.



Slotting With Hacksaw Improved by Blade Alteration

If two or three hacksaw blades are used side by side in the standard hacksaw frame for cutting slots, the tension on the blades



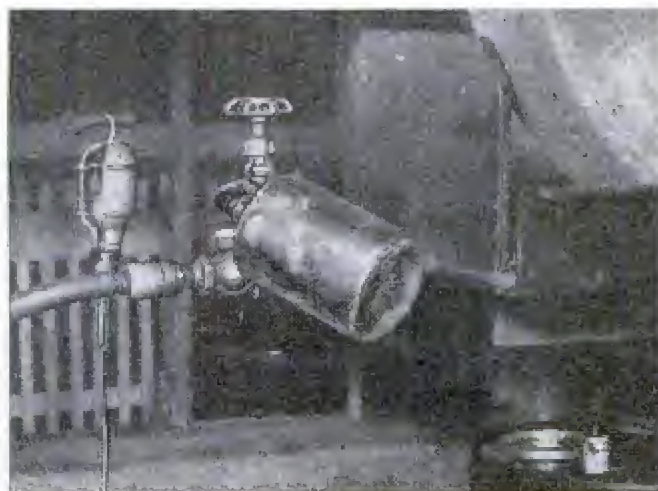
is never equal because of the angle of the pins in the holders. This frequently causes one of the blades to buckle and bind, resulting in inaccuracies and possible breakage. To correct this tendency, tape the blades together at each end and then file the registering holes at an angle corresponding to that of the pins in the holders. This assures that when the blades are

placed in the frame they will be drawn to the same tension when the frame is tightened. File identifying marks on the blades as shown so that when removed from the frame they can be reassembled in the same order. — Earl R. Goddard, Denver, Colo.

Matching Upholstery on Car Door

Having to repair a small hole in the upholstery of a car door and finding that no matching fabric was available, one auto trimmer removed an armrest and cut out a piece of the material directly under the rest. The patch, which was slightly larger than the hole to be repaired, was cemented inside the opening. The armrest covered the hole left by cutting away the patching fabric. — Russell L. Card, Tweed, Ont., Can.

Muffler for Service-Station Lift Improvised From Oilcan

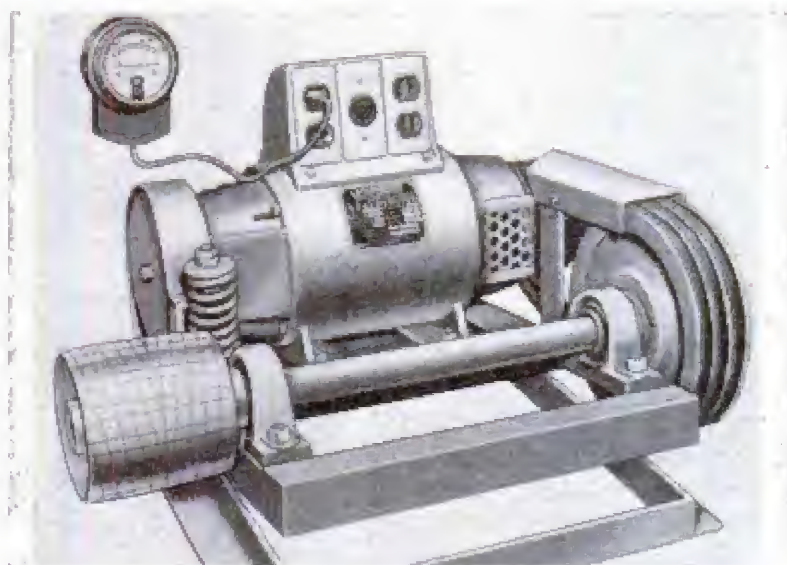


To eliminate the ear-splitting sound of air being exhausted from a hydraulic car lift, one service-station owner fitted the lift exhaust with a muffler made from a 1-qt. oilcan filled with steel wool. Instead of opening the can in the conventional way, a hole was punched in the center of the top end and the oil drained out. After the can was packed with steel wool, a few vent-holes were punched in the bottom and sides with a nail. Then, the muffler was mounted on the outlet valve of the lift by means of a short length of $\frac{3}{4}$ -in. pipe soldered in the hole at the top of the can.

George Boyer, East Pepperell, Mass.

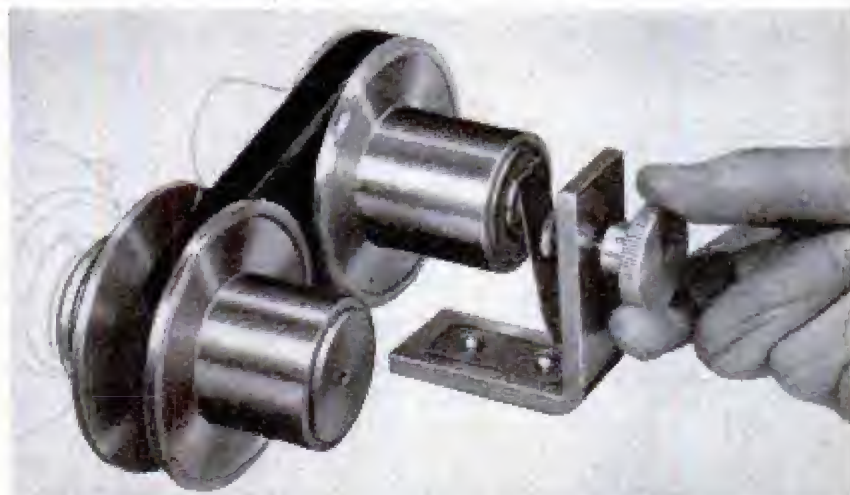


SHOPPING



NEW DIRECT-READING MICROMETER is adjusted to the work in the same way as conventional mike, but the readings appear in openings, or windows in the thimble, thus making usual computations unnecessary

STAND-BY A.C. GENERATOR is now available to farmers and dairymen for use when rural power lines fail. Farm tractor is hooked to generator, furnishing power for lights, milking machines and pumps



NEW SPEED CHANGER that features two variable-pitch sheaves is now available. One sheave is spring-loaded and mounted on motor shaft. Other is controlled manually and is mounted on driven shaft

THE BOTTLED-GAS TORCH pictured at the left is suitable for work requiring temperatures up to 2200 deg. F. Flame is adjustable to pin-point size and the torch is charged from a bottled-gas tank



FOLDING BUCKSAW, or bow saw as it is often called, is a new item in trail equipment for campers and outdoorsmen. Note how saw folds to compact unit with teeth covered to prevent injury when handling or carrying in a pack. It comes in two sizes with blade lengths of 20 and 24 in. In the larger size, it is suitable for cutting logs up to 10 in. in diameter. Weighing only 2½ lbs., it carries easily on the trail

FOR TOOLS



METAL PAINTBRUSH HOLDERS, or jackets, that keep brushes soft and ready for use have been made available. Holder supports the brush in a solvent with the bristles compressed slightly, thus retaining the chisel edge and preventing bristles from spreading. Two short legs on lower end of each holder prevent brush from touching bottom of container. Furnished in five sizes



A PORTABLE TOOL, which is hydraulically operated, is now supplied for cutting wire rope, round steel, chain and power cables. Hydraulic mechanism is operated by a built-in hand pump capable of exerting a 22½-ton thrust. Cuts 1¼-in. wire rope in 20 seconds



TWO NEW GAUGES that aid in sharpening drills up to ½ in. in diameter are pictured above. Left, this gauge slips over end of drill bit which projects through to a 118-deg. profile, or gauge. When drill point has been ground to the correct angle light cannot be seen between profile and cutting edges. Right, this gauge has a 90-deg. V-groove for holding drills up to ½-in.

THIS NEW SOLDERING IRON heats to soldering temperatures in 30 seconds and "idles" at 500 deg. F. with current consumption of about 25 watts. When booster switch is closed, current consumption is increased and temperature at tip is raised 400 percent

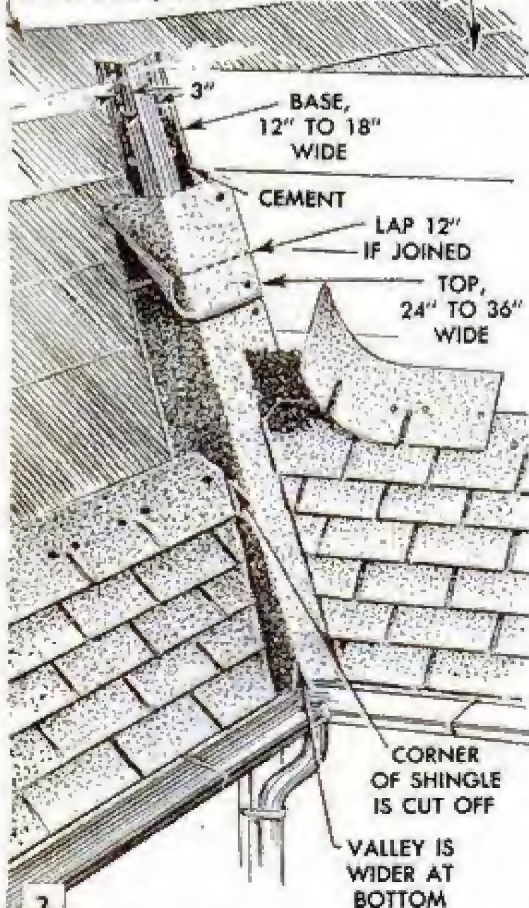




1

ROOFING IS EASY

No. 15 FELT (FOR NEW CONSTRUCTION)



2

VALLEYS ARE COVERED WITH DOUBLE THICKNESS OF MINERAL-SURFACE ROLL ROOFING

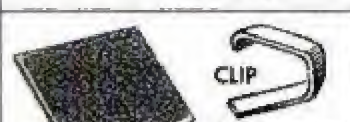
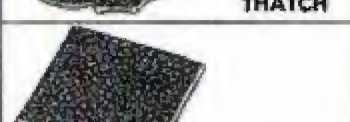
How To Apply Asphalt Shingles

By Sam Brown

Part I

ROOFING is the simplest of all the major repair jobs that the homeowner can tackle himself without professional help. It's easier to do than painting, except that you have to climb a little higher, work in a somewhat less comfortable position and swing a hammer instead of a paintbrush. Because of the mechanical features of the various asphalt-shingle patterns, the shingles practically lay themselves. If the first course is started correctly, you can't very well go wrong.

Selecting the shingle pattern: Data on several of the more popular shingle patterns, or types, is given at the top of the opposite page. The individual shingle is pretty much the same product in any type or style. It averages about the same weight per unit and has essentially the same proportions in the mineral covering. The difference in the style of modern roofing and the cost of the job depends on whether the shingles are laid single thickness, double thickness or triple thickness. Probably the most popular choice is the double thickness, or double coverage roof, and in this class the three-tab square butt and the three-tab hex strip shingles are leaders, especially on new work. Single-coverage shingles, such as Dutch lap, and interlocking

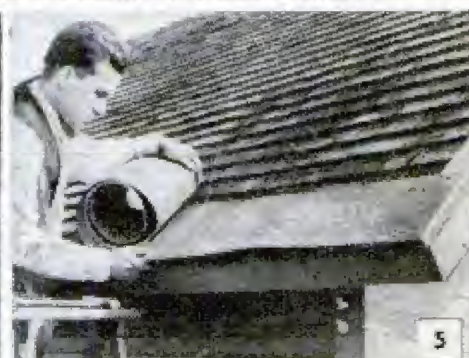
Asphalt shingles	WEIGHT PER SQUARE	UNIT SIZE	NAILS PER SQUARE	COVERAGE		
				PER BUNDLE	X-RAY VIEW	PERCENT
 3-TAB SQUARE	210 LBS.	12" X 36"	1.9 LB., 1" OR 3.2 LB., 1 1/4"	33 SQ. FT. (1/3 SQUARE)		1 PLY—2% 2 PLY—59% 3 PLY—39% 100%
 2-TAB HEX	167 LBS.	11 1/3" X 36"	1.3 LB., 1" OR 2.3 LB., 1 1/4"	50 SQ. FT. (1/2 SQUARE)		1 PLY—22% 2 PLY—63% 3 PLY—15% 100%
 3-TAB HEX	167 LBS.	11 1/3" X 36"	1.3 LB., 1" OR 2.3 LB., 1 1/4"	50 SQ. FT. (1/2 SQUARE)		1 PLY—22% 2 PLY—63% 3 PLY—15% 100%
 DUTCH LAP	162 LBS.	12" X 16"	0.9 LB., 1" OR 1.5 LB., 1 1/4"	50 SQ. FT. (1/2 SQUARE)		1 PLY—61% 2 PLY—29% 3 PLY—10% 100%
 THATCH	172 LBS.	10" X 36"	1.2 LB., 1" OR 2 LB., 1 1/4"	50 SQ. FT. (1/2 SQUARE)		1 PLY—14% 2 PLY—72% 3 PLY—14% 100%
 INTERLOCK	138 LBS.	16" X 16"	0.6 LB., 1" OR 1.1 LB., 1 1/4"	50 SQ. FT. (1/2 SQUARE)		1 PLY—60% 2 PLY—31% 3 PLY—9% 100%



NAILS SHOULD BE 1" LONG FOR NEW WORK, 1 1/4" FOR REROOFING



GOOD BASE IS ESSENTIAL. SPLIT AND NAIL DOWN WARPED SHINGLES



STARTER COURSE CAN BE INVERTED SHINGLES OR ROLL ROOFING



ROOF CEMENT IS VERY ESSENTIAL FOR TIGHT FLASHINGS AND VALLEYS



RIDGES CAN BE FINISHED WITH CUT SHINGLES OR ROLL ROOFING

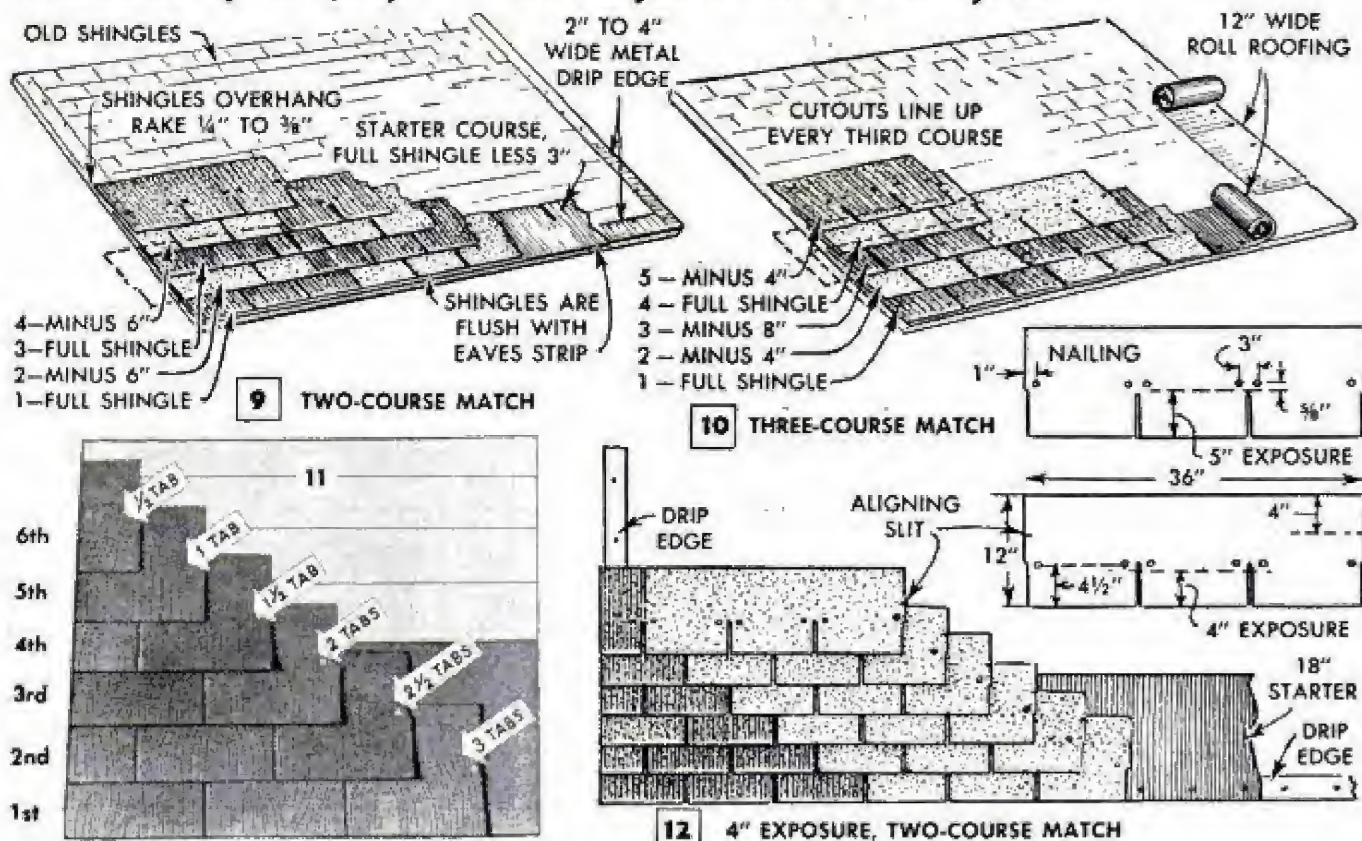
Basic operations common to all jobs

This page pictures and details nearly everything you need to know about a common roofing job. It's important to note the length of the nails recommended for new and old work, Fig. 3, and in over-roofing it's equally important to avoid driving the nails too far down, as expansion and contraction of shingles may cause breaks



DRIP EDGE OF 26-GAUGE SHEET METAL GIVES PROTECTION AT EAVES AND RAKE

Methods of Laying 3-Tab. Square-Butt Shingles



types, cost much less per job and make an excellent roof, especially when used for overroofing, that is, laying new shingles over an old roof in good condition. Shingles are sold by the bundle, each bundle containing enough units to cover from $33\frac{1}{2}$ to 50 sq. ft., which is $\frac{1}{3}$ to $\frac{1}{2}$ of a square, the square being an area measuring 10 x 10 ft., or 100 sq. ft. After measuring the roof and determining the total area in square feet, it's easy to figure the number of bundles required for the job.

Treatment of roof edges: The terms "eaves" and "rake" are used by builders to refer to the edges of the roof, eaves meaning the lower edges and rake indicating the run from the eaves to the ridge. If the old roof is in good condition to start with, it is unlikely that the edges will need any special treatment, but if the shingles are in poor shape then some preparatory work may be necessary. Figs. 3 to 8 inclusive picture roofing steps common to all jobs and Figs. 13 to 24 inclusive picture the step-by-step procedure, including the regular valley treatment, Figs. 2, 18, 19, 20 and 21. As a rule, the first step is to prepare the roof edges. Rake boards or metal drip edges are installed, the boards being installed in the same positions as indicated for the drip edges in Figs. 8 and 9. When overroofing a wood-shingle roof it is the usual practice to use rake boards of beveled siding, 4 to 6 in. wide, to form a drip edge along the rake. It also is good practice to cut away the shingles along the rake so that the board bears directly on the roof

boards with the thicker edge out. This has the effect of tilting the shingles slightly away from the edge, forming a watershed which prevents water from running down the edge of the roof and dripping from the fascia board. Some builders may even use 12-in. strips of roll roofing as in Fig. 10. It is a common practice to set the drip edges in roofing cement to prevent seepage of water under the shingles. On new roofs, Fig. 25, felt undercovering goes on first, then the drip edges and finally the shingles.

Preparing valleys: Figs. 18 to 21 inclusive show how the valley is prepared on old work. First a narrow strip of roll roofing is cut and laid in the space between the shingle ends to build up level. Then the full-width valley strip of roll roofing goes in, Fig. 18. Next, chalk lines are snapped to indicate the taper of the valley width, Fig. 19. Finally, lay a line of lap cement outside the chalk lines from top to bottom on both sides of the valley as in Fig. 20. Don't be confused by the forked arrow in Fig. 21. During heavy rainstorms when even a steep valley runs full from a point well up near the ridge, some water may take the direction of the small arrow, which makes it necessary to take the precaution of cutting the corner of each shingle and bedding the exposed edge in roofing cement or lap cement. Full-length valleys, such as those formed where the ridges meet at right angles at the same level, should be 6 in. wide at the top and should widen at the rate of about $\frac{1}{8}$ in. to the foot down to the eaves. Note that the chalk lines, Figs. 19 and 20,

Here's a Picture Story Showing Application of Square-Tab Shingles



STANDARD

THIN

THE BUTT



Lay a row of inverted shingles at eaves to form the starter course



First course starts with full shingle with the edge flush at eaves



Begin second course with full shingle less 6 in. Cut shingle from back



Four nails fasten each shingle. Nail straight to avoid cutting



Shingles are cut and flashed to all parts projecting above roof



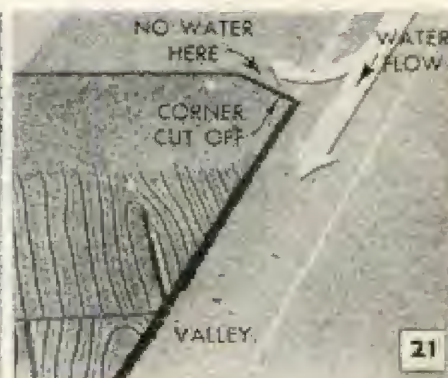
Two layers of roll roofing used in valley, same color as shingles



Chalk lines are snapped on valley to indicate trim line for shingles



Shingle ends at valley are bedded in roofing cement to turn water



Top edge of each shingle at valley is cut off diagonally as shown



Plastic roof cement assures tight joints at vent pipes and chimney

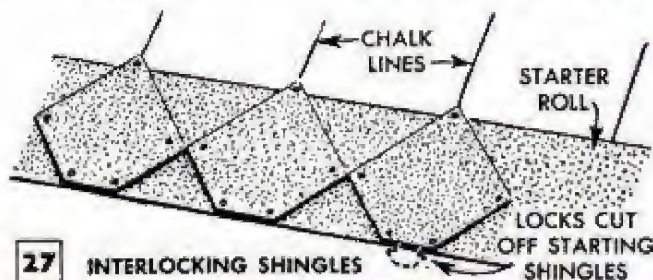
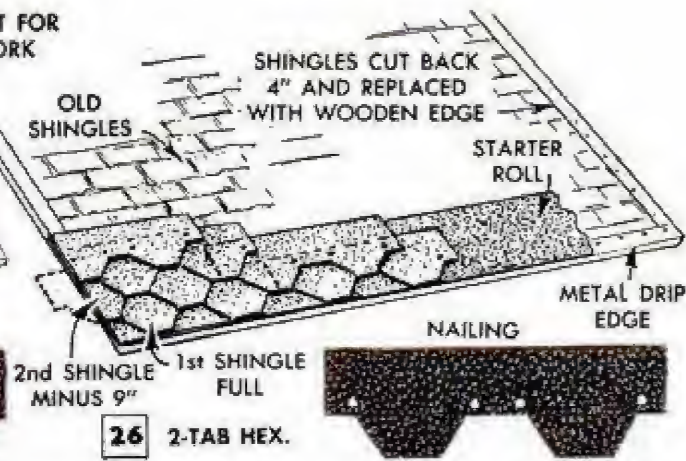
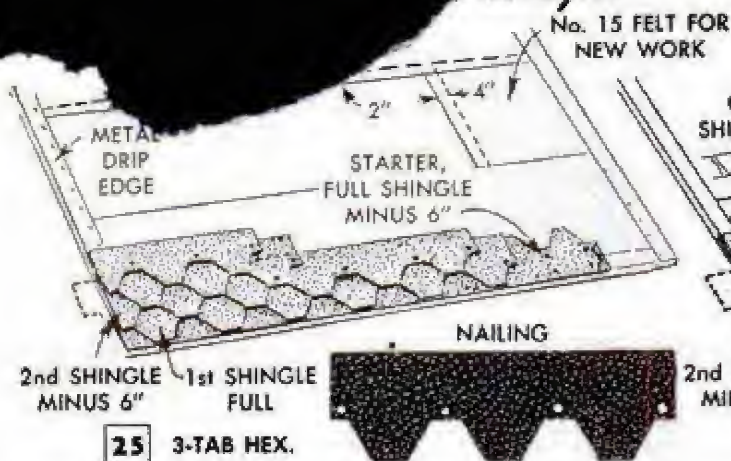


On overroofing jobs shingles often are fitted under old flashing



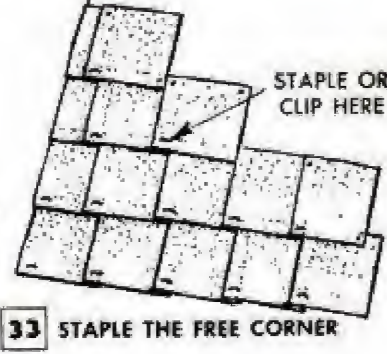
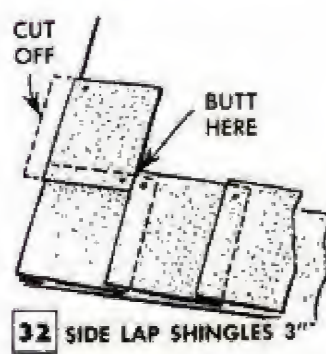
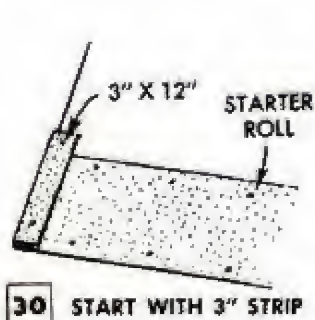
Ridges and hips can be finished with 12-in. strips of roll roofing

shingles



widen in about this relative proportion.

Laying shingles: With the drip edges and valleys completed, the rest is plain sailing on an ordinary roofing job. **Caution:** On a steep roof, Fig. 1, don't take chances! See that all ladders reaching to the eaves stand solidly and make sure that scaffolding and footboards are anchored securely before trusting your weight on them. Some roofers, working on high, steep roofs, take the added precaution of tying a light rope loosely about the waist or under the arms. The free end of the rope is thrown over the ridge and tied securely to a tree or some other solid anchorage on the opposite side of the building. Then, if you slip, or something lets go, the rope will save you from a possible serious injury. The starter course, pictured in Fig. 5, is a row of inverted shingles, Figs. 13 and 25, or a roll of roofing 12 to 18 in. wide as in Figs. 5, 10, 26 and 27. In ordinary roofing practice, the shingles overhang $\frac{1}{4}$ to $\frac{3}{8}$ in. at the rake edge and $\frac{1}{8}$ in. at the eaves when applied over old shingles. These overhangs can be slightly less over metal drip edges. Nearly all shingle units are self-spacing, that is, one butts against the other, and the head-lap and alignment are more or less automatically taken care of by cutouts, slits or other mechanical features of the individual shingle units. However, it's a good idea to snap a chalk line occasionally as the work progresses to check the horizontal alignment. An example of how the head-lap and alignment are governed by the cutouts and aligning slits provided on each



Three ways to join sidewalls



PLAIN BUTT SHINGLES ARE PRACTICAL WHEN ROOFING CAN BE NAILED INTO RECESS OF SIDING. ALSO GOOD ON SLOPES WHEN CEMENTED



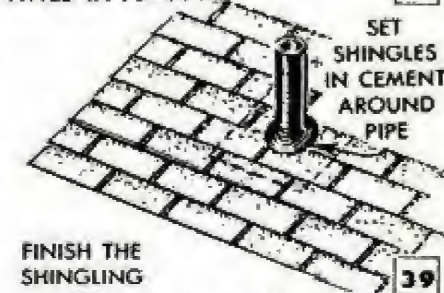
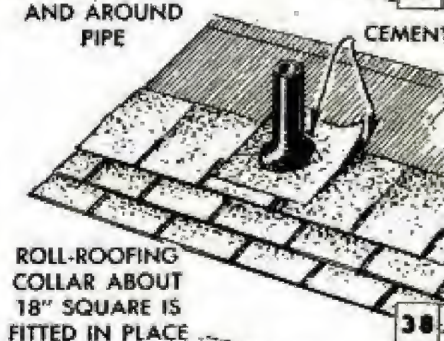
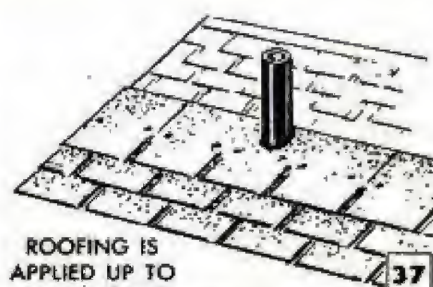
STEPPED SHINGLES MAKE A TIGHT FITTING JOB, ESPECIALLY WHEN CEMENT IS LIBERALLY APPLIED TO THE JOINT UNDER THE SHINGLES



METAL FLASHING WITH PREPARED FLASHING TIN IS GOOD STANDARD METHOD. EXPOSED FLASHING TIN IS PAINTED COLOR OF HOUSE

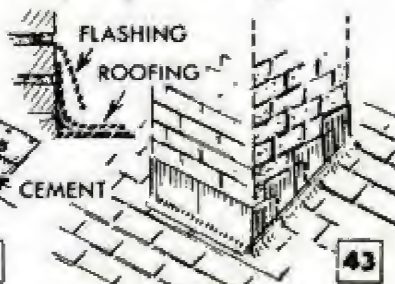
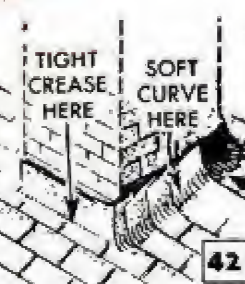
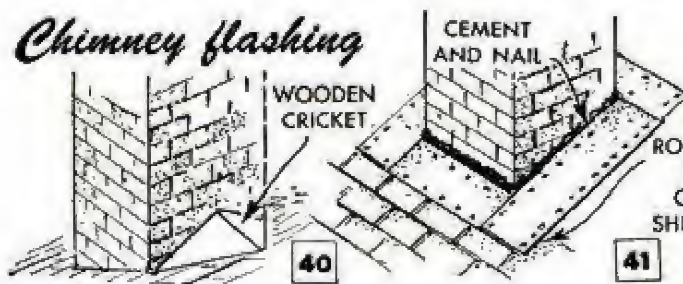
unit is the three-tab hex shingle. The usual exposure, or lay, is 5 in. to the weather. This means that after the first course the succeeding courses are set flush with the cutouts. Also, it is common to break the cutouts every second course, as in Fig. 25. This is done by alternating a full shingle unit and another with 6 in. cut off the outer end. This forms the starting shingle on the succeeding course. An alternate method is detailed in Fig. 26. Matching the cutouts on square butt shingles can be done by several methods as detailed in Figs. 9 to 12 inclusive. Other methods of laying different types are detailed and pictured in Figs. 27 to 33 inclusive.

Flashing to sidewalls, vent pipes and chimneys: Figs. 34 to 43 inclusive detail and picture the procedures in flashing the roof to various parts of the house structure to prevent leakage. Three methods of joining to side walls are pictured in Figs. 34, 35 and 36. How to flash to a vent pipe projecting through the roof is detailed clearly in Figs. 37, 38 and 39. Both metal flashings and self-flashings are used, the latter being made either from the shingles or from roll roofing. On chimneys that project from a steep roof at some point below the ridge, it is customary to fit a watershed, or cricket, on the upper side of the chimney as in Fig. 40. The cricket can be made of wood as suggested, but for maximum durability it should be made of galvanized sheet metal or copper. All flashings, except metal, should be coated liberally at the joints with roofing cement carefully knifed into all openings and well smoothed on the exposed surfaces.

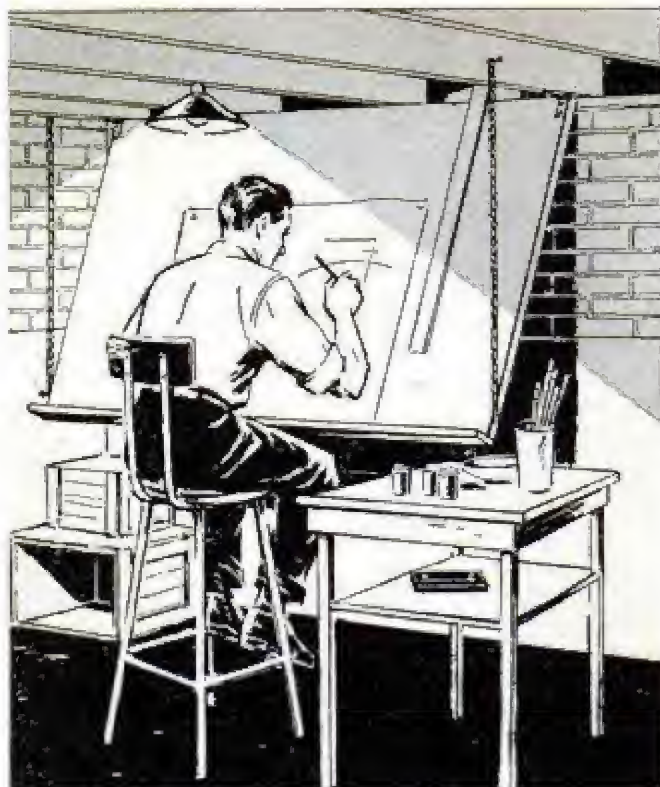


Pipe flashing

Chimney flashing



Here's the way to flash a chimney on an overroofing job. On steep roofs a wooden or metal cricket usually is fitted above the chimney as in Fig. 40. New shingles are then brought up to the chimney and roll-roofing strips are nailed and cemented in place as in Fig. 41. Job is then completed with shingles and cap flashing



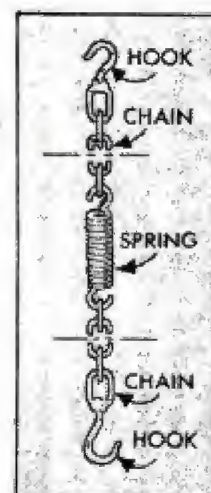
Drawing Board Hung From Ceiling Occupies Minimum Space

Free-lance artists who use a corner of the basement as a home studio will appreciate this large drawing-board easel which is hinged from the ceiling and folds flat against the wall for compact storage. Lengths of chain suspended from screws or nails driven into the ceiling joists hold the lower edge of the board away from the wall and permit easy adjustment of its angle. Storage space against the wall can still be used as the easel has no lower framework to interfere. A sheet of plywood, a drawing board fitted with extension arms or a large board built up of pieces doweled and edge-glued together, is hinged to two of the ceiling joists at the top corner of the wall. The chain links engage nails driven into the edges of the board. When folded flat against the wall the easel also serves as a mounting board for photocopy work.

Paul Will, Chicago.

Ladder Lashed to Truck Top With Spring-Fitted Chain

By anchoring each end of a ladder with two lengths of chain and a tension spring, the ladder is easy to fasten to the top of a truck and can be taken off in a jiffy, without the necessity of untying ropes. In addition, this method prevents rattling and keeps the ladder from working loose even on long hauls. Use two lengths of chain at each end of the ladder, connecting the lengths together with a tension spring as shown in the detail. Hooks at the ends of the chain engage the ladder rung and the truck bumper. The important point to remember is to use tension springs of sufficient strength to hold the ladder in place.



Opening in Floor Near Store Window Affords View of Basement Display



Their interest aroused by a gaping hole in the floor of one furniture store, many passing shoppers paused for a second look and went in to buy the merchandise so unusually displayed. The opening, which is cut through the floor just inside the show window, is large enough to afford a clear view of the basement showroom. A decorative railing around three sides of the opening doubles as a guardrail.

Grover Brinkman, Okawville, Ill.

Waterproof Patch for Masonry Wall

If the joints in a masonry wall begin to leak, it is easy to seal them with a waterproof patch of asphalt calking compound. Just remove the old mortar to a depth of 2 in., force the calking compound into the joint and then cover with new mortar.

TELEVISION TODAY

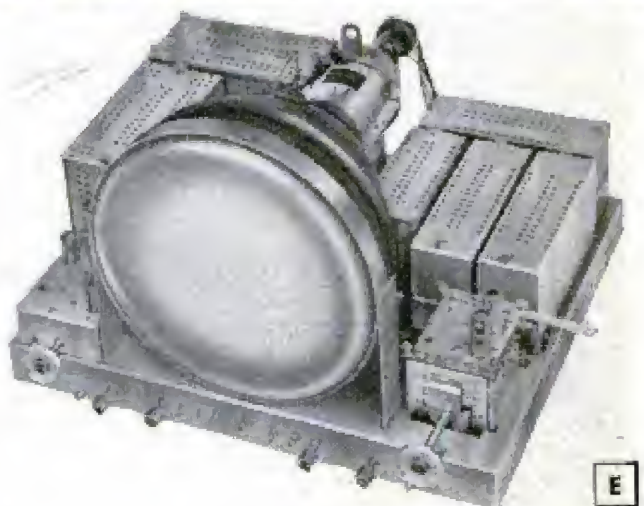
WHEN color television comes into common use, weird-looking vacuum tubes like this electron gun, photo A, may come into their own. An electron beam is fired through the tube, and action of the beam on current flowing through the spiral (coiled spring in a vacuum) causes a large increase in the power of the current. Color TV will have to be broadcast at very high frequencies over a wide band, and this "traveling wave" high-power amplifier tube is claimed to meet these special requirements.

Aluminum towers for TV antenna systems are to be seen in many fringe areas near cities where television broadcasting stations are located. The one shown in photo B comes in 10-ft. sections; it is made of lightweight structural aluminum.

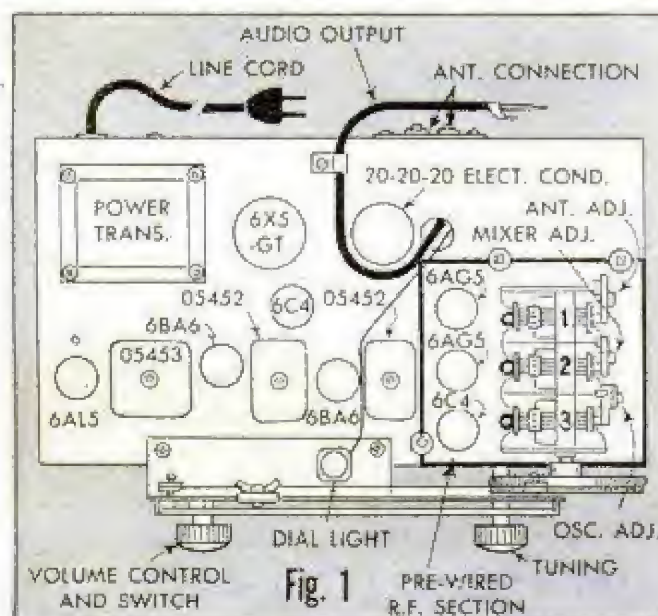
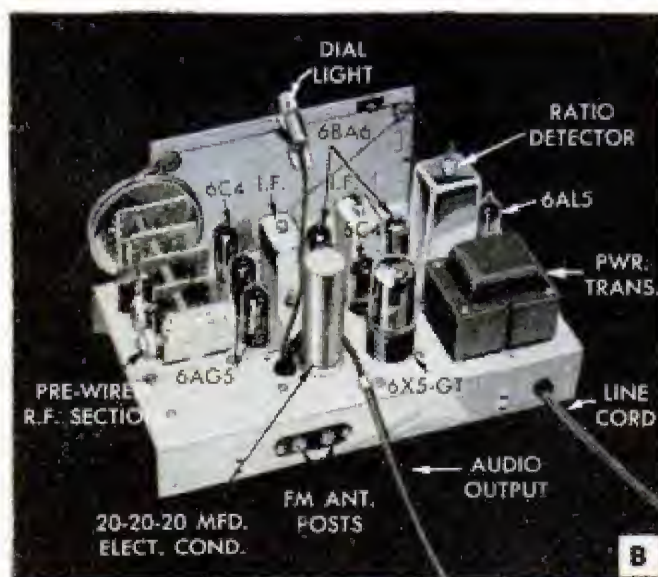
The TV antenna rotating device, illustrated in photo C, operates on 110 volts a.c., 60 cycles, with an input of 25 watts. It rotates 370 degrees clockwise or counter-clockwise, being instantly reversible from any point. The plastic control box operated at the TV receiver is color-toned to blend with most home furnishings.

Photo D shows a new 24-in. picture tube which will produce a direct-view picture almost as large as your daily newspaper page. It is shown mounted on a glass-to-metal cone sealer on the assembly line.

A new idea in television engineering is illustrated in photo E. It features an entire TV chassis organized into eight plug-in units, each performing its separate and distinct function. For repair and replacement, each unit can be removed without interfering with the rest of the set.



HIGH-FIDELITY FREQUENCY-



HERE IS an excellent FM tuner of advanced design that can be used with any good audio amplifier. It is easy to build as the r.f. front end is assembled and the i.f. coils are prealigned. This r.f. section comes in a compact prewired unit that mounts on the chassis base which is available cut, drilled and ready for mounting all parts just as shown in the photos.

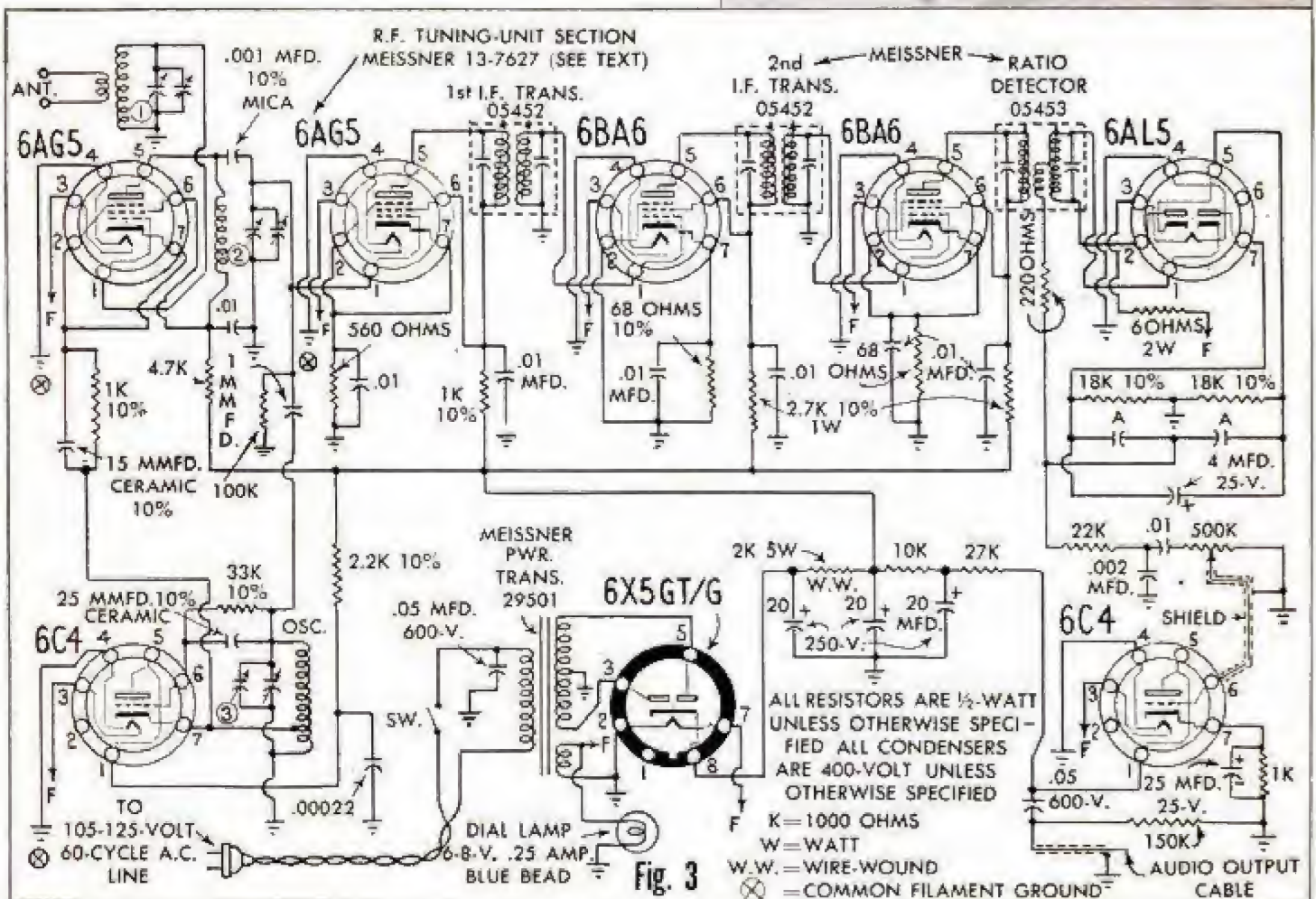
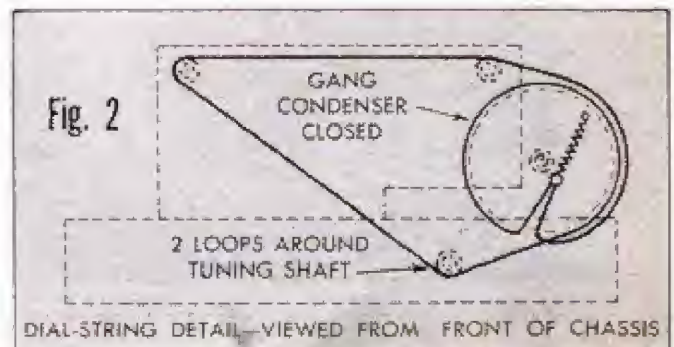
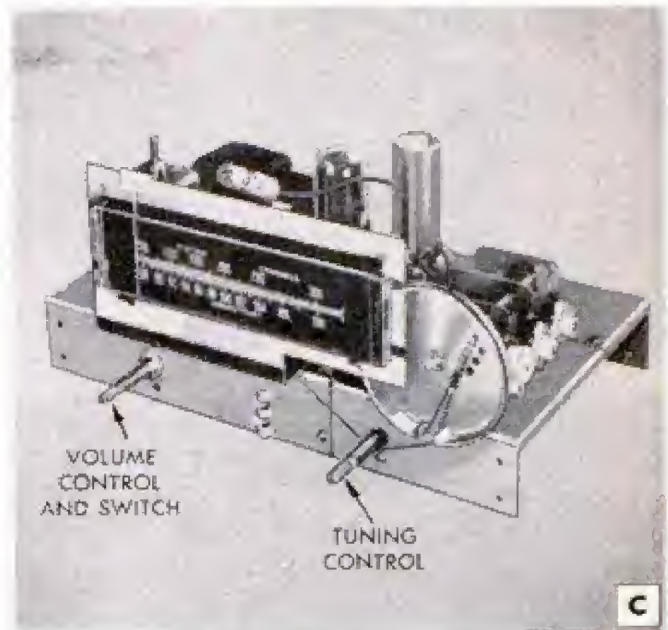
The parts are available in complete kit form from radio-parts houses and are standard in every respect. Although not intended for beginners, the construction is not difficult for experienced builders, and the results when used with a good audio amplifier are highly satisfactory even to critical music lovers. Photo A shows the completed tuner connected to an audio amplifier, and a good loudspeaker in an adequate enclosure. Photo B is a rear view of the chassis showing the binding post strip for an FM dipole antenna, and the audio output cable which is fastened to the chassis base by means of a clamp. A front view of the completed FM tuner appears in photo C. It may be housed in a standard stock cabinet or installed in a custom-made or home-built console combination. The chassis layout is shown in Fig. 1 and the dial-string detail in Fig. 2. A complete schematic circuit diagram appears in Fig. 3. All coils are of the reliable Meissner type, and every part is carefully selected to insure maximum results. Very little leeway in specifications can be tolerated in high-frequency FM circuits and the parts specifications given in Fig. 3 are those that are supplied in the complete kit shown in photo D. Those who do not wish to purchase the complete Meissner T-8CK kit shown in photo D can buy foundation parts which consist of the essential Meissner units. These are as follows: FM tuning assembly (catalog number 13-7628) with dial parts and hardware; main chassis base (No. 05965-A); power transformer (No. 29501); FM-i.f. transformers (No. 05452), and the ratio detector coil (No. 05453). The i.f. coils and the ratio detector, when supplied separately, are not prealigned.

A bottom view of the completed FM tuner unit is shown in photo E. Before the operation of an FM receiver is described, it is well to review briefly the theory of FM transmission. Unlike amplitude-modulated (AM) transmission in which the r.f. wave varies in amplitude to correspond with the impressed audio signal, frequency-modulated transmission does not affect the amplitude of the wave. It permits the wave amplitude to remain constant but varies

MODULATED TUNER UNIT...

wave frequency in accordance with the modulated signal, as illustrated in Fig. 4. If the carrier frequency of an FM broadcast station is, for example, 88 megacycles, its frequency under modulation may shift as high as 88,075 kc. and as low as 87,925 kc., a swing above and below 88 megacycles (88,000 kc.) of 150 kc. From this it can be seen that a single FM broadcasting station may cover a band width in the radio-frequency spectrum of as much as 150 kc. This is why FM broadcasting stations are located in the ultra-high frequency bands where there is a great deal more room for wide-range high-fidelity transmission than in the regular broadcast band.

Designed by well-known radio engineers especially for students and experimenters, this FM tuner circuit employs a double converter system which greatly reduces image response. The detector circuit, built around the 6AL5 tube, is called a "ratio detector." It develops an audio voltage that is proportional to the ratio of the swing in frequency above and below the average frequency, during frequency-modulation (FM). It responds only to FM signals, not to amplitude-modulated (AM) signals and, since static and other electric disturbances



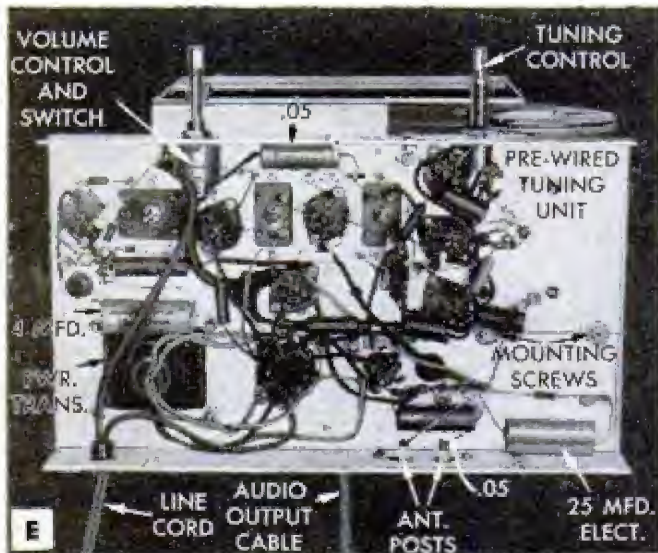
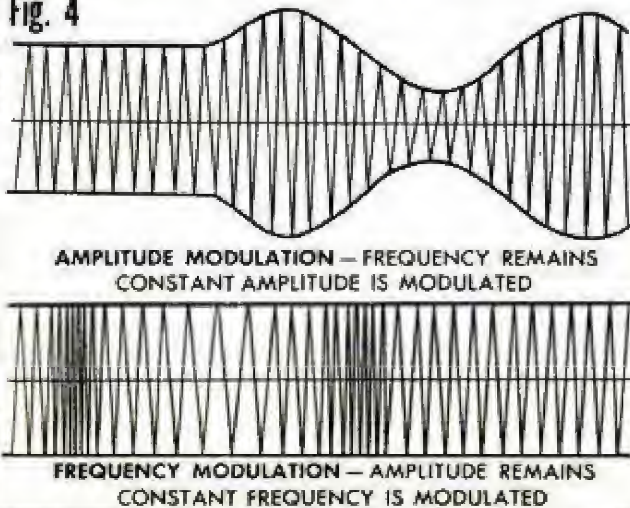


Fig. 4



are principally amplitude modulated, they are not reproduced, thus the performance of the FM receiver is noise-free.

The input or antenna coil tunes the entire FM band from 88 to 108 megacycles. The oscillator involving the 6C4 tube, shown at lower left in the circuit diagram, beats with the incoming signal to produce a lower frequency signal. The oscillator voltage is fed into the main receiver circuit at two points, in series with the cathode of the first 6AG5, and in shunt with the input grid of the second 6AG5 tube. After the second 6AG5, the signal is at 10.7-megacy-

cle frequency and is amplified by the two following 6BA6 i.f. tubes.

Just above and to the left of the 6C4 audio-amplifier tube, shown at lower right in the circuit diagram, is a 22,000-ohm resistor and a .002-mfd. condenser. This is the de-emphasis circuit of the FM receiver. FM signals are transmitted by the station with the higher frequencies accentuated. At the receiver these higher frequencies must be attenuated to provide a perfectly flat response. Any noise in the circuit is also reduced at this point.

A full-wave rectifier is employed in the a.c. power supply, and the filter circuit is a resistor-condenser type. The output of the 6C4 amplifier tube is approximately 7 volts maximum. This is just right for use with any phono amplifier, power amplifier or good radio set having phono input terminals. Because of the high frequencies involved in FM reception, it is desirable to use a standard outdoor FM antenna, which should be mounted as high as possible. Those who wish to make an indoor FM dipole antenna that will give good results in strong FM signal areas can do so by using a short length of 300-ohm Amphenol twin lead. This is the same transmission line material that is used for both FM and TV antenna lead-ins. Cut off a 57-in. length of the twin lead and bare the wires at each end just enough to twist them together and then solder these ends. Then lay the twin lead out flat and cut the lower wire in the exact center; bare the ends of this wire about $\frac{1}{2}$ -in. and tin them for soldering to the twin-lead transmission line to the receiver. This transmission line can be any length up to about 100 ft. You can fasten the antenna to any table or baseboard with the dipole broadside to the station.

This is often a good solution for the antenna problem when a roof installation is not practical; the twin-lead dipole can be tied with string to a horizontal collar beam in the attic. A twin-lead dipole of this description makes a good emergency FM antenna in an apartment house where roof antenna systems are not permitted. Merely fasten it to the picture molding with thumbtacks on the wall of the room that is broadside to the FM station. In some cases on upper floor apartments it can even be placed under a rug if there are powerful FM stations broadcasting in the vicinity. The length of the dipole is cut to 56 $\frac{1}{2}$ in. as this is about the center of the FM band. All parts for this model T-8CK FM tuner are supplied with the complete kit, with exception of the wire and rosin-core solder. A detailed material list is furnished with the kit and also with the essential parts, when they are supplied separately by parts houses.

Ten-Meter Transmitter Features Air-Cooled Final

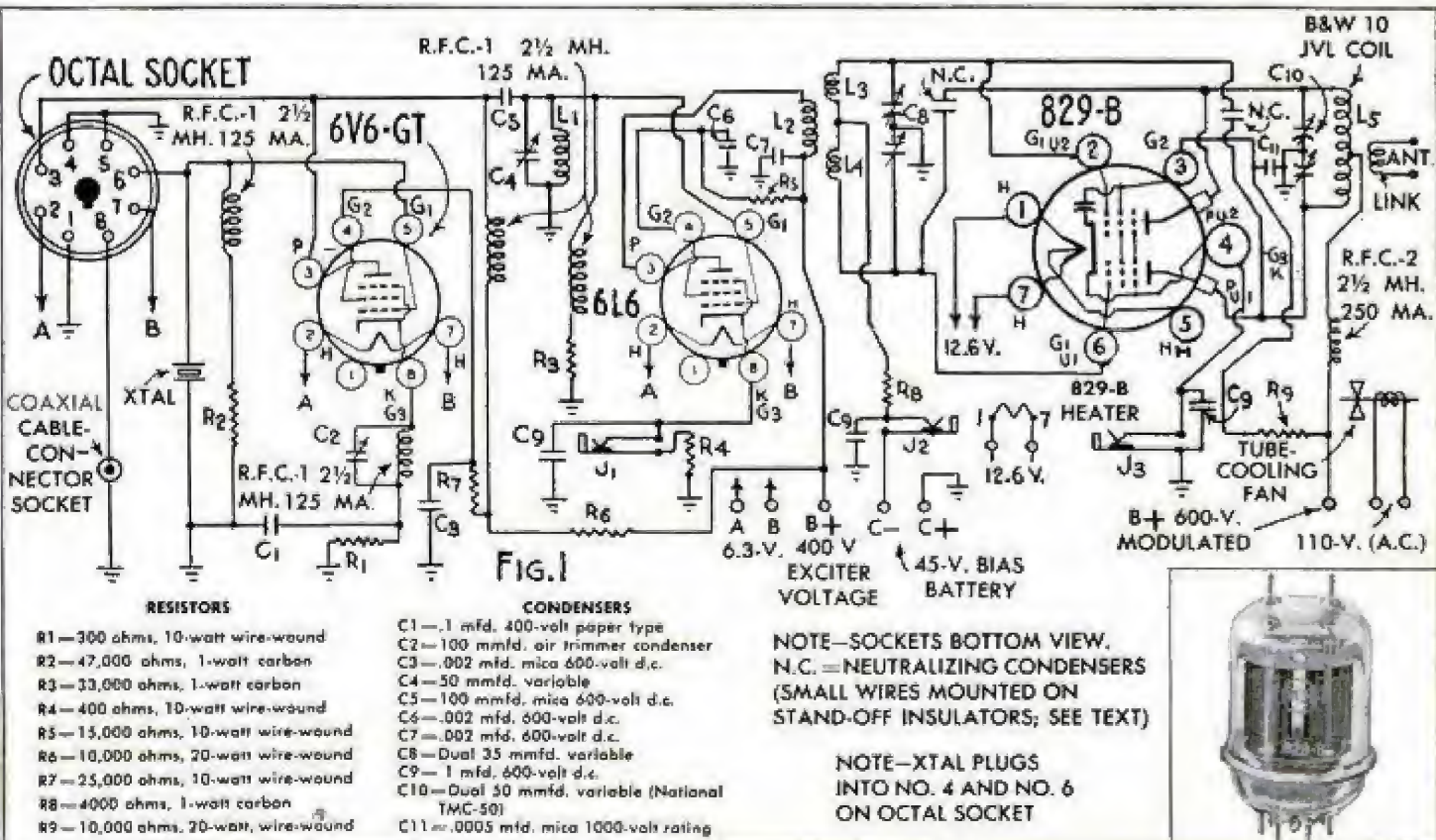
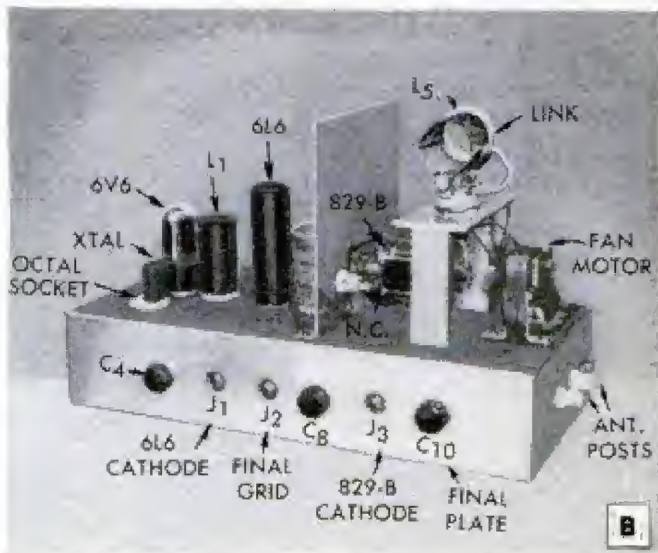
By Stan Johnson WOLBV

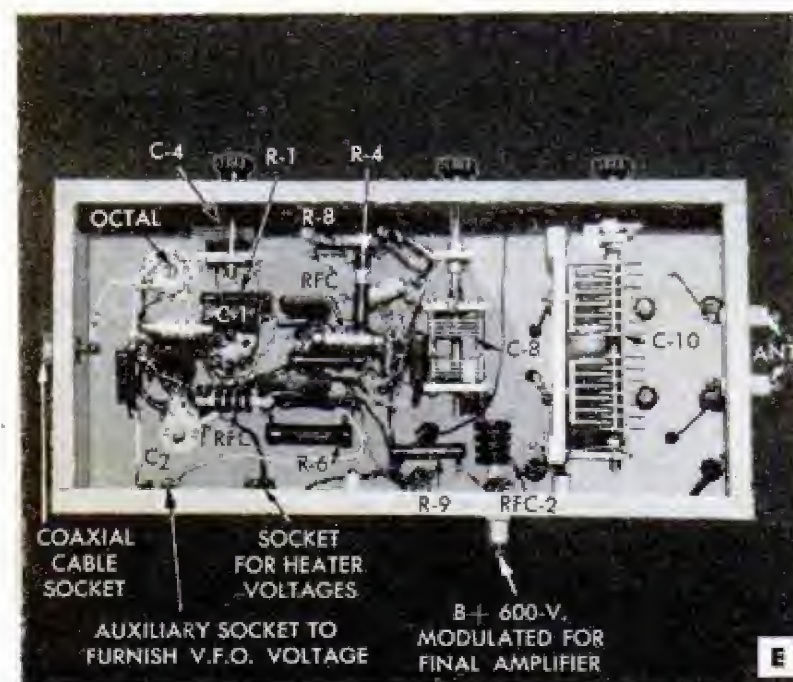
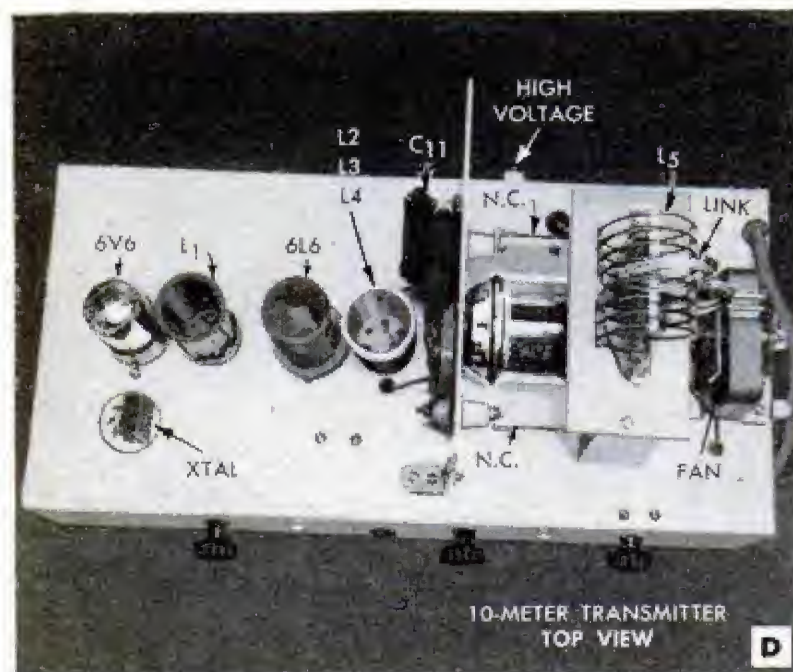
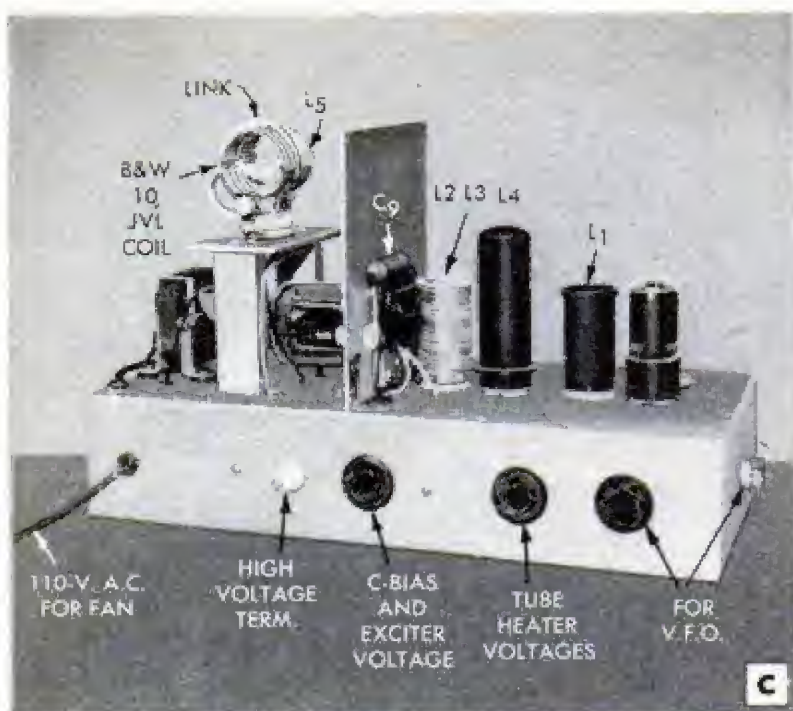
DESIGNED especially for those who built the 160-meter phone transmitter, R-386, which appeared in the January and March 1950 issues of *Popular Mechanics Magazine*, this unit can be operated from the same power-supply and modulator units. The two transmitters together provide the amateur radio operator, having a "B" ticket, with a highly effective pair of moderate power transmitters to work the two most important Class "B" phone bands. Like the 160-meter rig, this 10-meter transmitter section handles a full 120-watts input.

The 829-B final amplifier tube is an excellent high-frequency tube and performs on 10 meters as a pair of triodes on 160 meters. This is owing to a simple forced-air cooling system using a tube-cooling fan available from radio-parts houses.

Photo A shows the new 10-meter transmitter installed in the top section of the wooden rack above the original modulator unit. A complete circuit diagram of the 10-meter transmitter unit appears in Fig. 1. Various views of the completed unit are shown in photos B, C, D and E. The standard chassis base is 3 x 7 x 15 in.

Excitation for the 829-B is provided by a two-stage exciter. The 6V6 crystal oscillator uses a grid-plate oscillator circuit instead of more common tri-tet. This





utilizes W6YVO's input arrangement which greatly simplifies coupling the oscillator to an external variable-frequency oscillator (VFO). The crystal oscillator tube is simply shifted to the octal tube socket normally used for the crystal—and the VFO (which should have the type of output in which one side of the output coil is ground) is plugged into the coaxial cable socket on the chassis.

The buffer circuit is conventional, except that the output side is untuned and tightly coupled to the tuned circuit in the grid circuit of the final amplifier. This arrangement eliminates one tuning control. All metering for the transmitter is provided for by closed-circuit jacks inserted at points in the circuit which allow the jack frame to be grounded. The 829-B is mounted horizontally on a shield which separates the input and output circuits. Neutralization of this tube is provided by small wires mounted on stand-off insulators. Starting with the wires close to the plates, they are gradually pushed away from the plates and, if necessary, clipped off, until there is no evidence of grid current change when the plate tank condenser C10 is rotated through resonance (with plate voltage on the final off, of course). The plate coil for the final is mounted on a hardboard strip mounted on two small blocks of wood. Coil L5 is a small variable-link type that plugs into a five-prong tube socket. Coil L1 consists of seven turns of No. 22 enameled wire wound on a standard plug-in 1¼-in.-dia. form, and the winding is spaced out to ⅝ in. Coils L2, L3 and L4 are wound on a six-prong 1¼-in.-dia. form. L2 is 4¾ turns of No. 22 wire spaced to ⅝ in. and L3 and L4 are each three turns of No. 22 wire wound on either side of L2 and are spaced ¼ in. from it. Have the exciter portion working before applying plate voltage to the final. The cathode current for the buffer will be approximately 40 ma., grid current to the final 12 ma., and the cathode current of the final 240 ma.

Detailed student material list R-393 for this Ten-Meter Transmitter is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

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Doctor for Old Timers

(Continued from page 92)

Most of the beautiful antique watches require new crystals; modern crystals could be made to fit, but many of the originals had high crowns. So that's the way Cole makes them. With the help of James Morris, a glassblower at Northwestern University, Cole has developed a method for making these high-crown crystals. The two men soften heat-resistant glass in a flame, supporting it around the edge. At the right temperature the glass sags in the center. Presto—they have a high-crown crystal.

Cole doesn't restrict himself to work on watches alone—he also is an expert on old clock mechanisms. One of his prize jobs was the rebuilding of an 18th-century grandfather clock which now stands in the hallway of his new home. The clock is a complicated mechanism which shows the date and moon phase as well as the time. A 55-pound weight keeps it going for a full month without rewinding.

But most fascinating of all is the musical ability of the old clock. Behind the face are 25 bells which are actuated by a roller mechanism to play 18 different tunes, each tune lasting about 45 seconds. Rows of small pins, precisely set on the roller, trigger tiny hammers to play the tunes. When Cole started working on the clock, so many of the pins were bent, broken or missing that he decided to get a fresh start by removing the ones which remained. Then watchmaker Cole became musician Cole. He searched for old German tunes of the period when the clock was made, worked out the timing and harmony of the tunes, then set 600 pins in the roller to play the music. To date he has put five tunes on the roller.

Now that he has a house of his own, Cole has an immaculate basement workshop equipped with razor-sharp tools where he repairs or duplicates the hand carving on antique clock cases.

His latest project is a fascinating little "cuckoo watch" with a saucy bird that bobs back and forth to the music played by a "miniature slide trombone." Actually the music comes from a tiny whistle which plays an entire octave of notes. A slide in the whistle slips back and forth to play either of two tunes. Air for the whistle? A tiny goatskin bellows, operating through an ingenious arrangement of four compartments, furnishes a steady supply.

Cole is an inventor, too. He's working on a watch without a dial which shows time directly, like some electric clocks. Similar watches have been designed, but Cole will

(Continued to page 232)

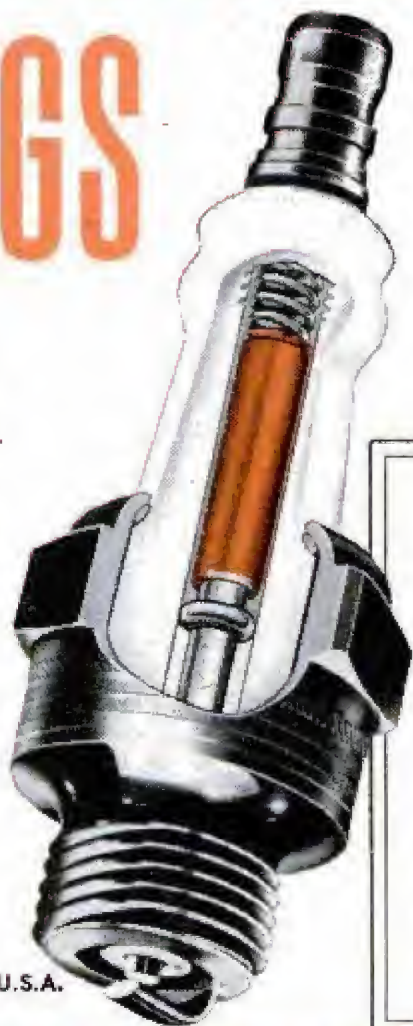
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MILLIONS of car owners from coast to coast are switching from narrow-gap spark plugs to the sensational new wide-gap Auto-Lite Resistor Spark Plug. They want smoother performance—money-saving gas economy—improved starting in extreme cold weather. They want the spark plug with the *Built-in Resistor* that doubles spark plug life and reduces interference with radio and television reception.



To get these remarkable benefits for your car, see your Auto-Lite Spark Plug Dealer today. You're always right . . . with Auto-Lite.

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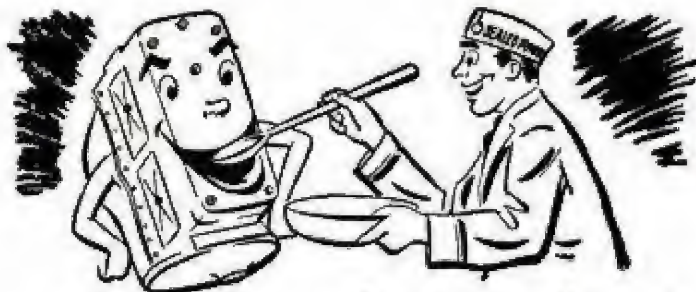
Cut-away view shows the 10,000 ohm Resistor which permits wider initial gap settings and makes these advantages possible. Double life under equal conditions as compared to spark plugs without the built-in Resistor.

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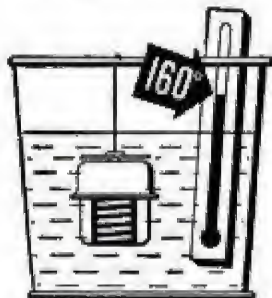


Care and Feeding of Engines

BY S. P. CORP

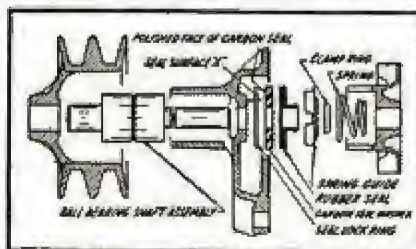
TIME TO CHECK THERMOSTAT

Winter is coming. You'll be putting in anti-freeze. Do you realize that different types of anti-freeze call for different thermostat adjustments? Alcohol boils at 180° F. If your thermostat is set higher than 165°, you will lose alcohol fast. But—if you use a permanent type anti-freeze—which boils at 223° F.—you will lose a lot of benefit unless your thermostat is set between 180°-200°. The best way is to decide which type anti-freeze you are going to use, and check your thermostat. Put thermostat in water with a thermometer and heat water. Note temperature as thermostat opens. If it opens too soon, or too late, for the anti-freeze you will use, get another thermostat! Also—be sure to check all hose lines and water connections. Replace hose that has begun to deteriorate!



FIX WATER PUMP LEAKS

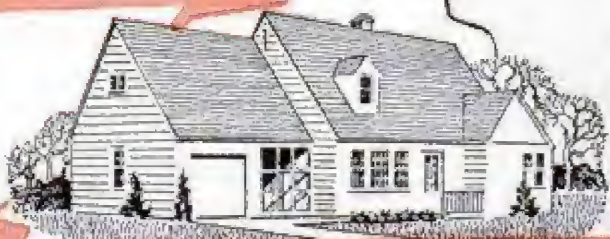
Pump leaks generally occur at the bottom of the pump housing. Such a leak means that you need to recondition the sealing surfaces of the pump. If you are using a water pump repair kit, be sure the machined surface against which the seal bears is smooth and true. Here is one design. If surface "X" is rough, pitted, or grooved, the seal will not hold. Tight seals are also required around the shaft on this particular design. The important thing is to know your pump before you start to fix it. Then be sure you have taken care of every seal. You may need to replace fan hub or impeller. Loss of anti-freeze can be both costly and dangerous.



ABOUT THAT RING JOB

Loss of power is costly, too. If you need a re-ring job before winter, be sure to use the best rings—Sealed Power Piston Rings. There is a Sealed Power Ring Set specifically engineered to do the best possible job on your engine, whatever the make, model, or wear condition. The best oil control ring ever made is the Sealed Power MD-50—the only ring with the Full-Flow Spring. It controls oil even in badly tapered and out-of-round bores. Write Sealed Power, Dept. G-9, Muskegon, Mich., for the free booklet, "7 Ways to Save Oil."

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Defective Shade Roller

Q—I have a roller shade over a large single-pane window which lately has refused to lock in the down position. I suppose this is due to a defective roller as the shade flies up as soon as it is released. The shade is nearly 5 ft. wide. Can the roller be repaired by the installation of new parts and, if so, how does one go about it?

C. G., York, Pa.

A—As a rule it does not pay to attempt the repair of a shade roller so badly worn that the ratchet no longer holds. Shade rollers of the spring type, even large ones, are quite inexpensive. However, there is one simple repair that sometimes effects a cure of the trouble you describe, at least for a time. The chances are, if the roller mechanism has not been damaged in some other way, that the shaft has become so badly worn that the ratchet dogs cannot engage and hold. On most shade rollers it is possible to slip a bushing cut from thin sheet metal over the shaft to take up the excessive play due to wear. You might try out this suggestion but, if it does not work satisfactorily, then the installation of a new roller is the only effective remedy.



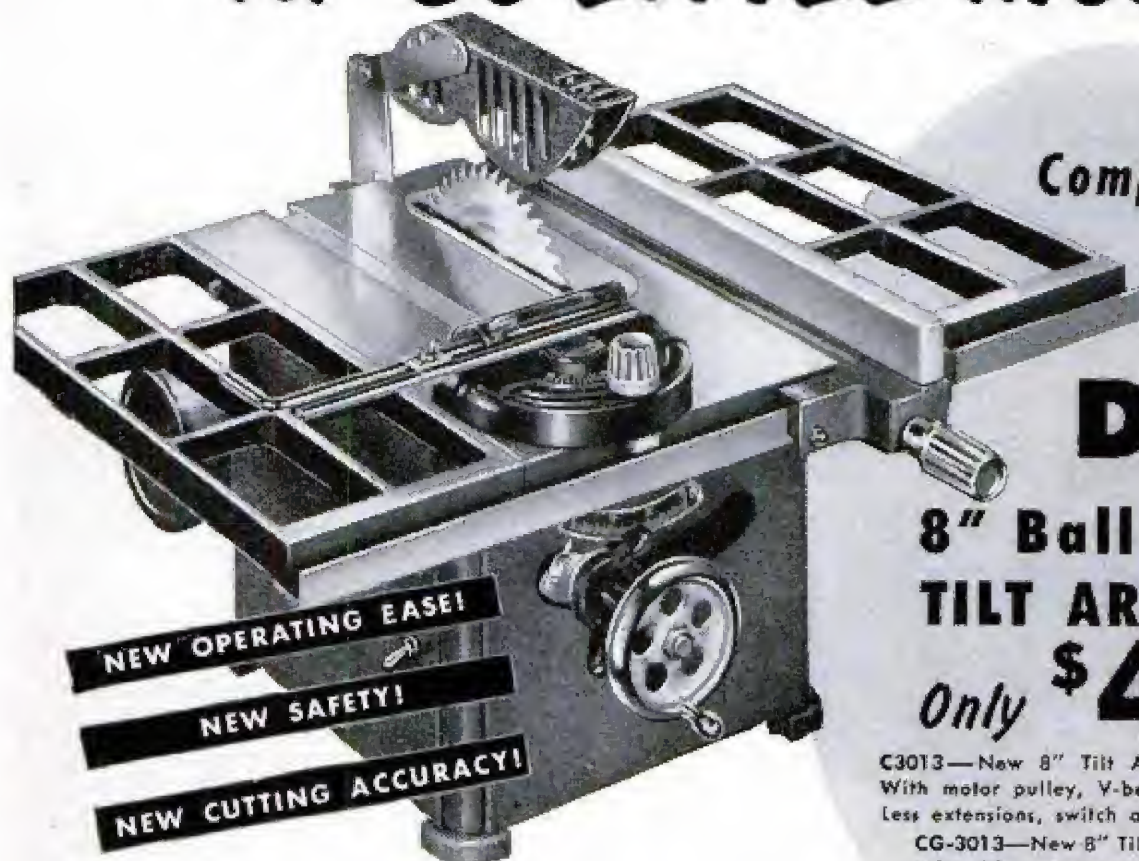
Water Damage

Q—Recently my home caught fire in the attic and considerable damage resulted from the water used to extinguish the blaze. Paint has peeled from the ceilings and plaster seems to be loose in places and in general is badly discolored. Do you think it is necessary to replaster? A. D., Milwaukee, Wis.

A—It is, of course, difficult for us to make a long-range appraisal of damage to walls and ceilings from water used to extinguish a fire. However, judging from your description of the condition of the ceilings and walls we would be doubtful about

(Continued to page 230)

Never before - SO MUCH SAW for SO LITTLE MONEY!



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NEW

DURO

**8" Ball Bearing
TILT ARBOR Saw**
Only \$43⁹⁵

C3013—New 8" Tilt Arbor Bench Model saw. With motor pulley, V-belt and 8" comb. blade. Less extensions, switch and motor, \$43.95 retail.

CG-3013—New 8" Tilt Arbor Bench Model saw with cast iron gridded extensions, as shown. With motor pulley, V-belt, 8" comb. blade. Less motor and switch . . . \$49.95

AS EASY TO BUY AS IT IS TO USE!

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Now you can enjoy the thrill of working with a husky, extra-capacity *tilting arbor design* saw . . . for little more than you'd expect to pay for an ordinary table saw! This smooth-running new ball bearing saw is **BIG** in everything but price. There is a full $7\frac{3}{8}$ " ahead of the blade . . . you can make cuts up to $2\frac{3}{8}$ " in depth. With gridded extensions the work table measures $26" \times 17\frac{1}{8}"$ —large enough to make big cuts with ease. The new Duro arbor lock tilts and locks the blade just where you want it . . . instantly, safely.

There is a full line of Duro Precision Power Tools including band saws, lathes, sanders, shapers, jointers, jig saws and drill presses. See them at your dealer.



WRITE TODAY for details and specifications on this new Duro 8" Tilt Arbor Saw. Or, if you would like to order and your dealer cannot supply you, send check or money order for \$43.95 or \$49.95 and your saw will be shipped prepaid promptly. (Illinois shipments, add 2% Retail Sales Tax.)

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This new Duro tilting arbor design saw features an exclusive "wide range" motor pulley which allows the belt to adjust itself to the angle of the saw blade. You get more positive drive . . . less belt twist . . . longer belt life. In addition, an interchangeable sleeve permits use of this new pulley on either $\frac{1}{2}"$ or $\frac{3}{8}"$ motor shafts.

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Please send me: Full details about the new Duro 8" Tilt Arbor Saw ☐. I'd like to order a saw right now . . . I enclose check ☐ money order ☐ for \$_____

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POINTERS FOR HOME PAINTERS



How to get smoothest jobs ever with wonderful new **NYLON** paint brushes!



Dip only half the length of the bristles in paint—on overhead work dip to only one inch. Tap off the excess paint. Don't scrape off on edge of can.

Nylon brushes hold a full load of paint. And they are ideal for nearly all finishes.



To get the best results, use a long, steady, even stroke, painting toward the surface already coated.

Durable nylon bristles don't break off and mar your work, and an independent research laboratory has found that nylon brushes paint smoother.



Use correct brush for each job. Poking large brushes into corners causes "fingering."

You can get a set of nylon brushes for every job, from touch-up work to wall and roof painting. They're made by leading manufacturers.

The next time you paint, try a smooth-painting, easy-to-clean nylon paint brush. You will never use any other kind. They're sold in paint, hardware and variety stores everywhere in all types and sizes.



Better Things for Better Living
... through Chemistry



(Continued from page 228)

the advisability of painting them. Rather we believe it will be necessary to replaster, at least the areas where you say the plaster seems to be loose. In any case, if the plaster has been loosened it cannot be considered permanent. Minor discolorations on the walls probably would be covered satisfactorily by paint but, if any areas of the ceilings or walls have been soaked sufficiently to crack and loosen the plaster from the lath, then it will be necessary either to patch the damaged parts or replaster the entire wall or ceiling. Replastering generally is advisable if the damage includes more than one fourth of the total area. Otherwise patch-plastering will probably prove satisfactory in a room of average size. Be sure that both the old and new plaster are thoroughly dry before applying paint.

Making Compost Pile

Q—I have available grass clippings and other materials for making a compost pile. But how to do it? One adviser says to excavate and pile the refuse in layers below ground level. Another maintains that the stuff will decompose just as effectively if piled above grade. Who's right? .
T. R., Rock Island, Ill.



A—In this case both your mentors are right, at least partially. The essential difference between the two methods is the matter of time. Obviously, all things considered and depending to some extent on the kind of material used, it will take longer for equal decomposition of composted material piled above ground as compared with that placed in an excavation. Where an excavation is objectionable, composting of such materials as you list above the ground level will be satisfactory but decomposition will take longer by natural processes. Decomposition can be hastened if desired by the addition of chemicals specially prepared for this purpose. When making the pile, either above or below ground level, select a low spot protected from drying winds by shrubbery or other barriers. Pile the fine and coarse material in alternate layers 3 to 5 in. thick, keeping the pile rectangular in shape with the edges higher than the center so that the depression will catch and retain both rain and snow. If chemicals are added, sprinkle the mixture on each layer so that it is equally distributed through the pile. During the drier summer months soak the pile periodically with water from the hose. Keep the sides of the pile vertical, as otherwise the pile will shed water. Some gardeners repile the material after a time and add new chemicals, but ordinarily this is not necessary.

Surfacing Driveway

Q—I need a hard-surfaced driveway from the street to my new garage which has just been completed. Length of the driveway will be about 50 ft. I will have to break the curb and install a ramp from the curb to the property line. What surfacing material should I use for the driveway and ramp—concrete, blacktop or flagstones set in cement?—S.M., Columbus, Ohio.

A—So far as permanence is concerned there is little choice between these materials, provided, of course, the work is properly done. Most recommendations call for a tamped gravel fill in an excavation 4 to 6 in. deep and, of course, a form will be required above ground for cement. Although there are various methods in use, flagstones are commonly laid on tamped gravel and the joints (spaces between the individual stones) are filled flush with cement mortar and brushed lightly before the cement sets. This makes a satisfactory driveway surface for light traffic and it is especially attractive for a winding driveway. Blacktop surfacing also is widely favored because of its durability and probably because the driveway is less conspicuous on a small lot when surfaced with this material. Don't forget that most municipalities require you to obtain a permit before breaking the curb and installing a ramp.

IF YOUR FIREPLACE ACTS
LIKE THIS... IT'S TIME TO
CLEAN THE CHIMNEY...

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IF YOUR CAR FEELS LIKE THIS
...IT'S TIME FOR MARFAK
CHASSIS LUBRICATION



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PULVERIZE them

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Grind-a-Leaf



The NEW

Easy Way

TO RID YOUR LAWN OF DRIFTING LEAVES

Here is the fast, effortless way to a beautiful, clean lawn through the autumn season. MOW-MASTER Grind-a-Leaf pulverizes leaves instantly—completely eliminates the need for raking, hauling or burning.— And in the summer time MOW-MASTER mows lawns velvety smooth or cuts tall grass and weeds by simply removing the Grind-a-Leaf attachment.

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TRIPLE DUTY MOW-MASTER

1—Mows Lawns 2—Cuts Tall Grass and Weeds
3—Pulverizes Autumn Leaves

have a moon-phase indicator and a mechanism that will show the daily time of the moon's rising and setting.

As you might suppose, Cole's own pocket watch is no ordinary timepiece. There's no face and you can look right through the glass case to see every cog in the mechanism. How does he tell time? When he pushes the stem, gongs strike the hour from one to 12, pause, strike the quarter-hour, pause again, then strike from one to 15 to indicate the exact minute.

"Takes several seconds to learn what time it is," Cole says happily.

The Campus Is On the Air

(Continued from page 128)

the microphone of the Penn menace. The words had no more than been spoken, when hundreds of Princeton students began to pour out of houses all over the campus. Every jalopy that could be coughed into action was soon bulging with students, who raced to block all approaches to the campus. Princeton was not painted that night.

The average college station has a staff of about 45 students, and they all get in plugs for their station at their respective dormitories, fraternities and sororities.

College radio stations usually broadcast all day Saturday and from 3 to 11 p.m. other week days. While the campus microphones are warm, the stations expect students to keep dialed to them except when switching to a commercial station to listen to some particular program. Broadcasts are even geared so that the students can listen while they study. The latter part of the evening is usually devoted to classical music.

College students would be expected to favor mostly popular music, but the stations receive as many requests for classical pieces as they do popular.

In a nation-wide survey conducted by its stations, IBS found that 45.8 percent of the students polled liked opera and operatic music. In the voting, opera ranked just between jazz (hot!) and spirituals, but ahead of quiz shows. Particularly significant was the higher cultural level of preferences by upperclassmen.

WKCR at Columbia has helped to educate its listeners to a type of drama as far removed as possible from soap operas. Historical dramas and fantasies have attracted big listening audiences. Other successful programs have used adaptations of stories by William Saroyan, Dorothy Parker and Stephen Vincent Benet.

College radio, as might be expected, is often spotty, amateurish. But there are flashes of brilliance, too. And those flashes rate an "A plus" in any grade book.

All-Steel Bodies Stronger Than Steel



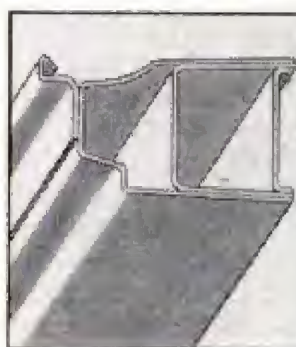
Chevrolet all-steel Bodies by Fisher not only have all the strength that is inherent in this strongest of metals, but *extra* strength due to advanced engineering design and precision manufacturing methods.

Take the center body pillar as an example of how Fisher design makes steel parts stronger than steel. The pillar is a self-reinforcing flanged double box girder—a structural form having far greater strength than a solid steel pillar of equal weight. (See illustration at the right.)

Look at the floor, too. It's a single piece of steel, made vastly stronger and more rigid by deep ribs, channels, and buttress-

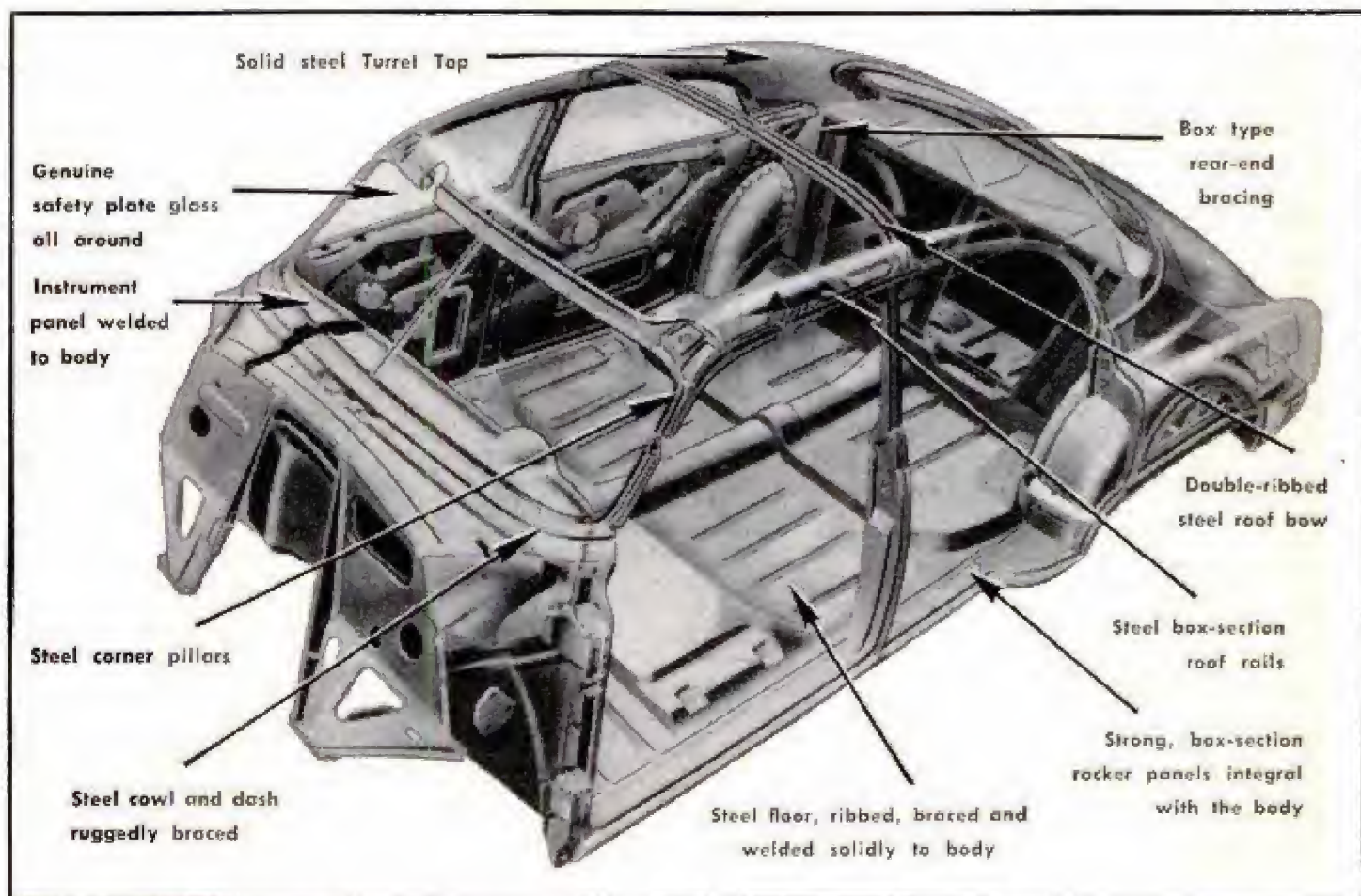
like brace, formed directly in the metal.

And so it goes throughout the body, as the larger view shows. It's a picture worth studying—for it tells clearly why *Body by Fisher* means *better by far*. That, of course, is another reason why Chevrolet is first and finest—for Chevrolet alone in the low-price field has this world's best body.



Your Chevrolet dealer invites you to see and drive the new Chevrolet. Make it a point to do it today!

Flanged double-box-girder body pillar—light, but exceedingly strong. (Left)



CHEVROLET MOTOR DIVISION, General Motors Corporation, DETROIT 2, MICHIGAN

Galloping Gold

(Continued from page 86)

They looked around to find the best possible stallion. Finally they chose Cream of Wheat, a splendid animal belonging to the Tom Goodnight and Roy Wayland ranch in Phoenix, Ariz. Out of this mating came the Fagan's first and most famous colt, Harvester, a stallion who has won a whole sheaf of ribbons, does tricks like a well-trained dog, and has sired about 50 registered palomino progeny.

The Fagan's proudest boast about Harvester, however, is that "former Secretary of Agriculture Clinton P. Anderson tried to buy him for his New Mexico ranch—but we wouldn't sell."

Today the Fagans have one of the largest palomino strings in the San Fernando Valley. Breeding and buying stock, they now own about 20 registered golden horses. Recently, Jim and Edna acquired the Bob Burns ranch at Reseda and both are active in the Palomino Horse Association.

Sometimes it's difficult to purchase high-grade palominos even if you possess the wherewithal. Owners of truly fine animals are reluctant to sell. The palomino enthusiast, therefore, who accidentally stumbles upon a promising colt feels the giddy sensation of a gold-hunting prospector chance-

ing upon precious nuggets in a stream.

The ideal color of a palomino's coat is described by that very apt phrase, "the color of a newly minted U. S. gold coin." Variations up to five shades lighter and five shades darker are allowed in palomino horse shows.

In California they like their palominos a solid color—an orange or a coppery hue. In Texas, the preference runs to a golden dapple. Manes may be silver, ivory or snowy white. Four stockings and a blaze or star on the forehead are allowed, but color on any other part of the body disqualifies the animal as a true palomino. Eyes should be brown or hazel.

You can frequently tell a palomino by his name alone, for the suggestion of gold carries over into the names of many registered animals: Sunny Gold, Golden Eagle, Harvest Sun, My Buck O' Gold, Banana Peavine, Nugget, King Midas, Casey's Champagne Blonde, Mustard, Desert Sunshine, Yellow Tack, Poppy de Oro, Taffy, Honey Harvest and Amber Boy.

Although golden horses have been known and valued for thousands of years, geneticists declare that palominos today are not a breed, in the strictest sense, but a color type. In other words, you cannot expect to mate a palomino mare and a

(Continued to page 236)



*Hi-level needs water
only 3 times a year!*
In Normal Car Use

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70% longer average life!*

AVOID battery failures, get longer battery life, with the new Prest-O-Lite Hi-Level Battery that needs water only 3 times a year in normal car use. Helps prevent a major cause of battery failure. In addition, Hi-Level gives you Fibreglass mats to keep power-producing material in the plates for longer life. Make your next battery a Prest-O-Lite Hi-Level.

PREST-O-LITE BATTERY COMPANY, INC.
Toledo 1 Ohio



*In tests conducted according to
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STEVENS MODEL 311

Double Barrel Shotgun
12, 16, 20 and .410 gauge

STEVENS MODEL 94

Single Barrel Shotgun
12, 16, 20 and .410 gauge



Two-way, top snap action for either right or left hand shooters, is a feature of the Stevens Model 94 "single." Lock-up is positive and rigid — can't shoot loose. Unbreakable coil springs . . . chrome molybdenum firing pins and *positive automatic* ejector are other quality features.



There's no better, more reliable double barrel shotgun action, *regardless of price* than in the Stevens Model 311 "double." The coil spring—hammer—sear mechanism of proven design (used in most expensive double guns) gives clean, crisp, trigger pulls—split second hammer fall.

You get more shotgun for your dollar, *plus* more fine gun features, when you buy a Stevens double or single barrel shotgun. That statement has been proved by the tens of thousands of shooters, over the years, who have made these guns their first choice. And, by the fact that Savage is the world's largest builder of single and double barrel shotguns.

Plan right now to own a Stevens "double" or "single" this year—for pest and sports shooting. See these "first in the field" values at your dealer's. Write for free catalog describing the complete line of Savage, Stevens and Fox Shotguns and Rifles.

SAVAGE ARMS CORPORATION
Firearms Division, Chicopee Falls, Mass.



MORE FINE GUN FEATURES

STOCKS—New redesigned wood stocks and fore-ends, walnut finish, on both Model 94 and 311.



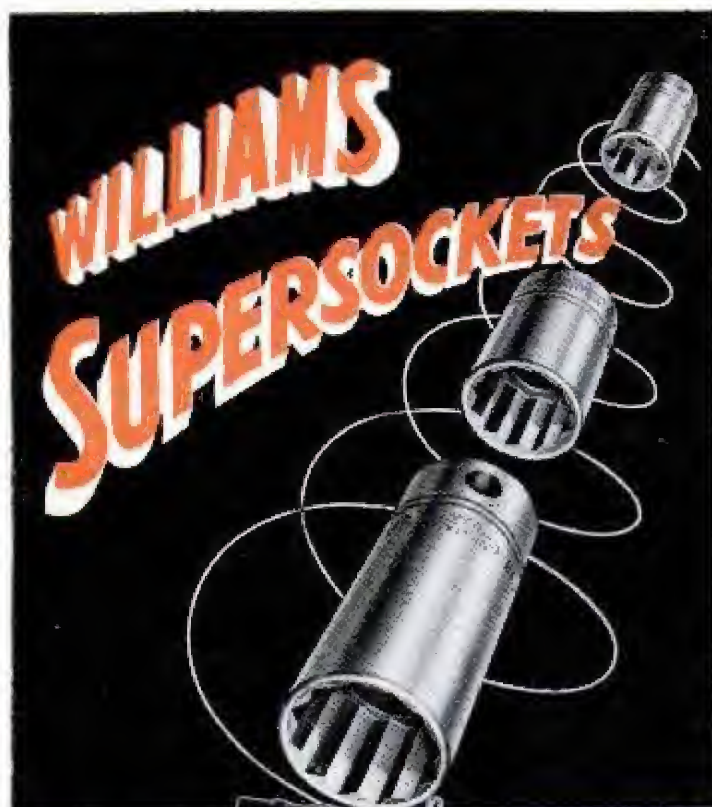
Barrel and Lug forged in one piece — one of many fine gun features found in these low priced Stevens models . . . features which mean unfailing dependability . . . top shooting qualities.



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Set No. S-10
21 Sockets
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WORLD'S MOST FLEXIBLE WRENCH SYSTEM

The engineered flexibility of Williams "Supersockets" permits the combining of sockets, handles and accessories to create special wrenches for special jobs. Available in five different patterns, with drives ranging from $\frac{1}{4}$ " to 1" square, and with socket openings from $\frac{3}{16}$ " to $3\frac{1}{8}$ ". Sold by Hardware Dealers, Automotive and Industrial Distributors. Write for "Supersocket" Catalog A-50.



J. H. WILLIAMS & CO., Dept. M, BUFFALO, N. Y.

palomino stallion and always get one of the golden-colored colts. He may be a taffy blond, but he also may be an albino or a sorrel. Breeders say that colts come out about 85 percent true palominos some years, only about 50 percent others.

Some strains of palominos have already indicated that the palomino breed is on its way. The Pirate Gold and Golden Don strains of Texas, the Harvester and Pal-O-Mine blood of California are all prepotent lineages whose stallions sire a high percentage of true palomino colts.

At the present time, interest in palominos is growing like bluegrass in the spring. More breeders are acquiring golden horses every day. The two-toned pinto, the spotted appaloosa, the snowy albino and other horses that feature color all have their devotees. But the golden palomino seems to be leading the popularity parade at the moment.

Mayhem on Wheels

(Continued from page 151)

the rear quarter panel was caved in. Such is the ability of the modern car to take huge amounts of punishment that this wreck went home under its own power and raced every week from then until the end of the season.

This sort of thing is the exception; however, as the usual stock car starts its competitive life as a junked or burned-out wreck. After being put in near-perfect mechanical shape, the car is given a flashy paint job and is ready for the slaughter. The paint job usually outlasts the car.

Stock cars are just that—strictly stock. No racing parts may be added, especially insofar as the engine is concerned. Some alterations may be made though, in line with safety requirements and better handling. Excess tin is trimmed from the fenders; bumpers are replaced with channel iron and heavy steel grilles, in some cases.

Special racing tires may be used, especially on asphalt tracks. Asphalt is a tricky surface, according to the drivers. It wears a tire to a peculiar shape, with a round shoulder on the right side and a sharp one on the left. Consequently, tires for use on this surface are capped with a special thick tread without grooves. The cap is molded in the shape in which the asphalt would ordinarily wear the tread. This causes the tire to wear evenly and enables it to get full traction at all times even under the screeching stress of a racing turn. An ordinary stock tire wouldn't hold up for one full event.

Extra shock absorbers are essential as

(Continued to page 238)

Wonderful fun — ENDLESS GOOD TIMES



RIDE A HARLEY-DAVIDSON *HYDRA-GLIDE*

NEW pleasures await you in motorcycling, world's greatest sport! Adventure, travel, thrills, fascinating friends! Every trip is delightfully different, every moment one to be remembered as you take in exciting races, hillclimbs, endurance runs and go on gypsy tours, sightseeing trips and other club events.

And what a difference it makes when you're riding a Harley-Davidson *Hydra-Glide*! Roughest roads smooth out like magic, hills fade away, day-long riding is really comfortable! Get your share of this exhilarating fun. You can own a Harley-Davidson on easy terms. See your dealer today.



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Send me *free* copy of ENTHUSIAST Magazine filled with motorcycle action pictures and stories, also literature on latest models.

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DEALERS: Valuable franchises are now available for the full line of famous Big Twins and the 125 Model. This is your opportunity to line up with the greatest name in motorcycles. Write or wire for complete information today.



THAT MUCK —not in my car?

YES, mister, two pounds of the horrible stuff. After 5,000 miles, that's about average. But your repair bills may be way above average—if you don't get a new **PUROLATOR Refill** for your oil filter—quick!



If you've been neglecting to have your oil filter checked, chances are there's horrible muck like this in your car. So when you change your oil this fall, start fresh with a *new filter refill*.

Be sure you get a Purolator* Refill—the accordion type that filters more *completely*, hence saves more substantially on repair bills. Costs only \$1.38 to \$3.00, depending on make of car. Inserted in a few minutes.

P. S. If your car has no oil filter, a *complete* Purolator, both housing and refill, costs only \$6.50 or a bit more, depending on make of car. Purolator Products, Inc., Rahway, N. J., and Toronto, Ontario, Canada.



*Reg. U. S. Pat. Off.

are sway bars and stabilizers. The left front spring is usually fastened down to prevent loss of control on the turns.

Cars range from the biggest to the smallest. Cadillacs and Crosleys have appeared several times. These extremes don't work out too well however; the big heavy cars are too clumsy for the short turns while the little jobs don't have the power to pull out of trouble.

Fords are the perennial favorite. Up to the present, the '39 coupe was considered tops for racing. Promoters are now insisting on later models, however, preferably '46 and later. The later the better.

The reason for this, according to Andy Granatelli, Chicago promoter, is that the '39s threatened to make the "stocks" a one-design race. This, he says, is sure death as far as audience appeal goes. The thing that is causing other types of racing to drop off in popularity is the uniformity of looks and performance of the racing cars. This makes for "parades," changing the races into a game of follow the leader with the first car into the stretch leading the rest like the fabled piper of Hamelin.

Age limitations and other restrictions will, the promoters believe, tend to alleviate this problem for the stock cars. Newer cars coupled with slam-bang driving should produce a nearly irresistible show.

People often wonder what makes a fellow want to go into this sort of thing. Most of the drivers and owners claim it's the money. This is in large part true. But there is another big reason and that is the urge to get into a car and go a little faster than the law deems proper and at the same time work off a head of steam. Many of us have, at one time or another, had the itch to relieve some of life's frustrations by plowing through traffic with a total disregard of consequences. In a stock-car race you can do just that.

The money, though, remains the big attraction for the drivers. The pay is good—for the top drivers. The others barely make expenses, if that. All hope eventually to walk off with a feature win and carry off some of the heavy sugar. It's an all or nothing proposition. Since the purses in these events run anywhere from \$2000 to \$10,000 it is obvious that even with a large field of cars the top positions can pay off several months' salary in one night.

"A sharp-looking car, license to push said car to its limit and a crack at more 'geetus' than can ordinarily be made in months! What more could a guy ask? If you don't win now, there's always the next track," was the way one driver put it.

Anybody know where there's a burned-out '46 coupe?



New RCA overseas teleprinter service by radio, first open to the public, now links New York and Holland.

Now "Flying Stenographers" span the sea!

You are familiar with *teleprinter* service which delivers a typed message, by wire, at high speed. Now this useful service takes to the air on a person-to-person basis, and is spanning the Atlantic Ocean by radio!

This new achievement, called TEX, was developed by RCA engineers and European experts. Its heart is an amazing machine that thinks in code, detects errors which may have come from fading

or static—and automatically insists on a correction!

If, when RCA's "TEX" is at work, a letter becomes distorted, the receiving instrument rejects the character and sends back a "Repeat, please" signal in fractions of a second—until a correct signal is received. Like other RCA advances in radio, television, and electronics, RCA's TEX system helps make radio waves more useful to all of us—and in more ways!

See the newest in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Radio Corporation of America, Radio City, New York 20.



RCA Research and pioneering provide a firm basis for the superiority of RCA Victor home television receivers—the best buy on the 1950 market.



RADIO CORPORATION of AMERICA
World Leader in Radio — First in Television

New!
NO WASH!
Non-Inflammable!

Peels Off Paint

Now you can "strip off" any finish safely, easily, without mess.

Old-fashioned, inflammable solvents work by "dissolving," leaving a sticky, waxy surface that must be carefully washed, or "neutralized." But Klean-Strip penetrates all layers of old paint and actually "breaks" the bond between the bottom layer and the surface to be stripped.

Klean-Strip changes any finish into a wrinkled film that is easily peeled off with brush or putty knife. Leaves surface smooth, clean and dry.

Buy Klean-Strip whenever you buy paint. At better paint, hardware and department stores.

KLEAN-STRIP REMOVER

Product of W. M. BARR & CO.
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ANGLE HEAD WRENCHES

\$9.55

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7 Sizes $\frac{3}{8}$ " to $\frac{3}{4}$ "

**FOUR USABLE WRENCH POSITIONS
IDEAL FOR USE IN CLOSE QUARTERS**

Heads are set at 30° and 60° angles. Both openings are same size. By switching ends you can turn nuts in narrow swing areas where standard wrenches cannot operate. Hammer forged from finest alloy steel. Special Snap-on heat treating process toughens and hardens wrench from skin to core. Thin blade. Heavy chrome plated. Satisfaction guaranteed or your money back.

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I enclose () Check, () Money Order for one set of angle head wrenches V-807K \$9.55 postpaid.

NAME

ADDRESS

CITY STATE

Treasure Hunt in a Lost World

(Continued from page 78)

the mud like a cement mixer and drops it in metal boxes which jiggle. Water pouring into the boxes from the drum keeps flushing silt out, while gold and diamonds settle to the bottom of the boxes. At day's end, the jiggle boxes are sealed and hauled away to a safe place for inspection.

Most such contrivances are jerry-built. One old jungle gold prospector rigged a crude head frame of saplings over a deep excavation and dropped a bucket from a pulley. He hauls his pay dirt up and down with an antique Model-T Ford engine.

Occasionally, groups of men get together and build three or four cascades, lined with clay. Water, fed in from the river, splashes over each level. Pay dirt thrown in every few minutes is automatically washed down, leaving the gold and stones.

But in all the systems there is great wastage. "Just let me at the tailings of all the old workings down there, and I'll make a fortune out of what's been left behind," says a Caracas gem merchant.

Primitive though their methods may be, there's nothing cowardly about the prospectors when it comes to the risky business of diverting a river to get at its bed. In valleys it's easy to dig a ditch, dam the stream and sluice it out the new canal. But up in the jungle gorges, the stream must be dammed, lifted on a flume and carried away overhead. Such fluming, made of riverside timber lashed together with liana vine and calked with the bark of a native tree, is rickety and dangerous. One of these affairs collapsed under the weight of the river it carried, and killed 70 men in a claim just as the prospector's pay dirt had been uncovered, and "the diamonds," he said, "lay gleaming like stars in the skies."

But gold and diamonds are not the only prizes on the Venezuelan frontier. There are the fabulous recent finds of iron ore up near the Orinoco. And oil, coming out of coastal areas at the rate of half a billion barrels yearly makes the country the world's second largest petroleum producer. And the surface hasn't been scratched. Every city is a boom town, huge construction projects are under way. But you don't rush in with a suruku, or a drilling rig and start digging. You begin to realize that a frontier is no Yellowstone picnic park when you know that oil prospectors must guard their jungle wildcats against the poison blowguns of Indians; or when you hear the story of Big Steel's hunt across roadless wilderness for iron, and the problem of getting ore out once it was found.

"Under Construction"

To all of us, those are stirring words. They signify Americans . . . forever building, developing, improving, for the future.

To *roadbuilder* Edward D. Eveleth of Arcadia, California . . . they mean ribbons of smooth highway, from coast to coast.

But to *Army Reservist* Edward D. Eveleth, those words apply as well to the defense forces of his country. He realizes that these forces must be continuously improved . . . constantly revitalized.

That's why Sgt. Eveleth devotes two nights and one weekend a month to his local unit of the U. S. Army Organized Reserve Corps. If and when . . . he is determined that he and his unit will be ready.

Find out how you can serve your country and yourself in the Army's Organized Reserve Corps. Visit your nearest U. S. Army and U. S. Air Force Recruiting Station or call your local ORC Unit Instructor.

Sgt. Eveleth Directing Bulldozer Operator at Fort MacArthur, California



*Make \$20 to
\$30 a Week*
**EXTRA
MONEY**



MACHINE SAW FILING PAYS UP to \$2 or \$3 an HOUR

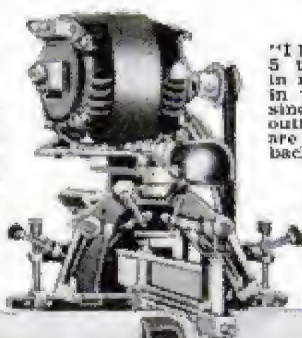
Turn your spare time into CASH—sharpening saws with a Foley Automatic Saw Filer pays up to \$2 or \$3 an hour. You will find you can make \$20 to \$30 a week in your spare time as a starter.

You can work in your basement or garage—no experience necessary. "The first saw I sharpened with my Foley Filer came out 100%"—writes Clarence E. Parsons. No canvassing—"I advertised in our local paper and got in 93 saws"—says M. L. Thompson. The Foley is the only machine with which you can file all hand saws, also band saws and cross-cut circular saws.

SEND FOR FREE BOOK "INDEPENDENCE AFTER 40!"

Shows how you can get business from home owners, farmers, carpenters, schools, factories, etc. With a small investment, no overhead, no stock of goods to carry, you can get right into a cash business—and possibly later on develop into a full-time repair shop. Send coupon today for Free Book. No salesman will call.

"Each saw I filed got me six more and business has been picking up that way since a year ago. If it keeps up I will have to buy another Foley Saw Filer." — William C. Baldwin



"I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back." — Len Crego

"Have filed over 2200 saws in 18 months. One customer always brings another." — E. A. Fink

FOLEY

SAW FILER



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Send FREE BOOK — "Independence After 40."

Name _____

Address _____

Look What's Happened to the Little Old Schoolhouse!

(Continued from page 138)

schoolhouse was built, are expensive during an era of high building costs. But the modern architect is paring big chunks off the cost of his buildings by eliminating all the marble slabs and expensive gingerbread which once served as a symbol of community pride.

But still some cities feel they just can't afford new buildings. Though such communities can't increase the number of classrooms, they can modernize old schools on a small budget.

Walls and woodwork can be painted bright, flat colors to increase the light and make school a truly colorful experience. In poorly lighted rooms a "ceiling of light" or "egg crate ceiling" can be installed. Perkins was the first architect to install such a ceiling, at Lincoln School, Park Ridge, Ill. Long bands of fluorescent lights were fastened to the ceiling of the room. Then a false ceiling—a virtually uninterrupted area of honeycomb metal louvers—was suspended just below the lights. The result: you can't see a bulb anywhere in the room, yet the entire ceiling is aglow.

For more money the community can re-equip its classrooms with movable, non-glare desks, designed to mold the student into the correct posture. Tanbark and sand can be spread over playgrounds to minimize broken arms and skinned knees. Black slates can be repainted a soft green with a new surfacer. And why can't fathers who enjoy woodworking spend a few nights in the manual-training shop turning out attractive bookshelves, storage cabinets and play blocks for every school in town?

The work can be an exciting community experience, with results just about as sparkling as a new school building. Parents will relish the job and youngsters may find school more of an adventure than playing hockey. Perkins' biggest compliment came from a wild-eyed little boy who had just spent a few days in one of his buildings: "You know, school can be more fun than a Hopalong movie!"

Record Cleaner Dissipates Static

Static charges built up in the handling and playing of phonograph records are eliminated by a cleaning agent which is applied to the grooved surface. Such charges attract and hold dust and dirt to the surface of the record, creating noise and causing excessive wear. The cleaner leaves an extremely fine antistatic film which adheres to the surface for several months.

Columbia Records, Inc.

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CRAFTSMAN
8-in. Tilting-Arbor
Bench Saw

Only **\$54.50*** Cash

Complete with blade, guard, splitter, non-kickback pawls, rip fence, miter gauge, two pulleys, and V-belt

\$5.50 Down; \$5 Monthly on Easy Terms

Complete outfit **\$108.95*** Cash
as shown

With motor, bench, front and 2 side table extensions
\$11 Down

* Prices slightly higher south of the Ohio and west of the Mississippi rivers

Sears Easy Terms make it easy to buy your bench saw NOW... pay as you enjoy using it!

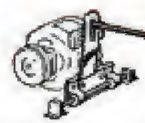
Look at these superior features!



Work stays level! Blade and guard (not table and work) tilt any angle up to 45°, for much faster, easier and more accurate operation!



Exclusive! Tilting, raising and lowering blade are all controlled by a single hand wheel... at front of saw!



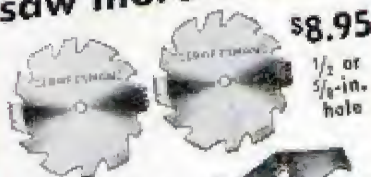
Floating motor mount fastens to bench for easier tilting. Controls belt tension; reduces saw vibration; lessens strain on saw frame!

Sears Bench Saws are completely equipped; NOT stripped models, as are some saws on the market!

We know of NO finer, more complete Outfit at anywhere NEAR this low price!

Big, accurate, precision-built, and low priced... this superb, heavy duty CRAFTSMAN tilting-arbor saw outfit meets the most rigid requirements of professional and amateur craftsmen! Many exclusive features! Large smooth-ground table of cast semi-steel (20x17 in. without side extensions; 34x20 in. with extensions), has insert removable for dadoing. Depth of cut up to 2½ in. Saw has automatic leveling guard, non-kickback pawls, splitter, accurate miter gauge and rip fence, 2-in. machine and 2½-in. motor pulleys, ½x40-in. V-belt, motor mount, and 8-in. combination blade (½-in. bore). Complete outfit includes ½-H.P. 3450 R.P.M. ball bearing capacitor motor (110-120-volt, 60-cycle A.C.); two side table extensions; front roller extension; and steel power tool bench (height adjusts 22 to 32 in.). See this sensational CRAFTSMAN outfit at your nearest Sears Retail Store TODAY!

These Accessories will make your saw more useful!



\$8.95

½ or ⅝-in. hole

DADO SET. 6-in. Dados, rabbets, grooves, etc., with ½ or ⅝-in. arbor bench saws.



\$1.39

CUT-OFF WHEEL. 8-in. Cuts tile, concrete, stone, metals. ½, ⅝ or ¾-in. arbor.



\$4.50

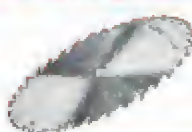
NAIL-CUTTING SAW. 8-in. For rough work (rips, crosscuts). For ½ and ⅝-in. saw arbors.

CRAFTSMAN Top Quality Circular Saws in 6, 7, 8, 10 and 12-inch sizes



Crosscut (Cut-off) Saws

\$229
8-in.



Rip Saws

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Flat-ground Combination Saws

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8-in.

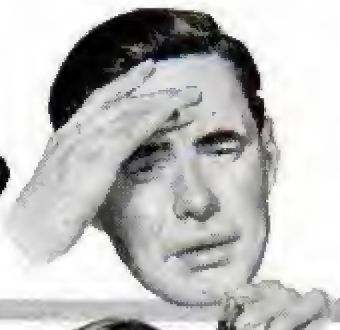


Hollow-ground Combination Saws

\$389
8-in.

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- SOFTENS hardest brushes—usually less than 30 minutes.
- CLEANS OUT fresh paint instantly!
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Pint Can only 50c
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Sifting the Story of an Ancient Race

(Continued from page 122)

Down through the ages how many dusky aborigines had made the bluff shelters at least a temporary abode? How did the first human being, whose shadow fell across the threshold of these shelters, look, and in what dim period had he lived? All these questions and more have spurred the Thomases on to countless discoveries.

By how many centuries are those artifacts that lie nearest the surface separated from those which are unearthed at a depth of five or six feet? They are not certain, neither are other archaeologists who have examined the remains of this ancient race.

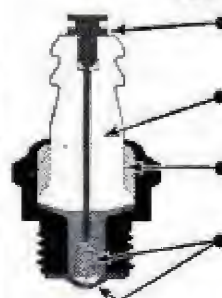
Low-level excavations have revealed no implements used by an agricultural race, and flint weapons unearthed at the bottom of the debris-filled pits are noticeably inferior in quality and workmanship to those found near the surface. Evidence points to the fact that the bluff shelters in the Illinois Ozarks were occupied for short periods by two distinct cultures or by a single culture acquiring certain characteristics of the other through trade, warfare or some like manner. It is quite likely that the shelters were used more as a place of transient habitation rather than as a permanent home. The scarcity of burned bone in the bluff shelters seems to indicate this, the Thomases believe.

One of the cultures that occupied the shelters used a grit-tempered pottery and had crude chipped-stone artifacts; the other culture is characterized by shell-tempered pottery and finely made triangular projectile points.

Buried treasure, the quest for the unknown and the effort to recreate ancient civilizations have always intrigued mankind—thus it is with Charles and Joe Thomas. They'll never be satisfied until they can unearth the complete story of the Bluff Shelter people who inhabited the caves and cliffs of the Illinois Ozarks.

CHAMPION V-GLOW PLUGS

for model engines only



- **CHAMPION TERMINAL**—assures better center electrode seal and provides sturdier electrical connection.
- **CHAMPION-CERAMIC INSULATORS**—proved dependable in millions of Champion Spark Plugs.
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- **CHAMPION "THERM-O-FLEX" CONSTRUCTION**—longer element life, more dependable performance.

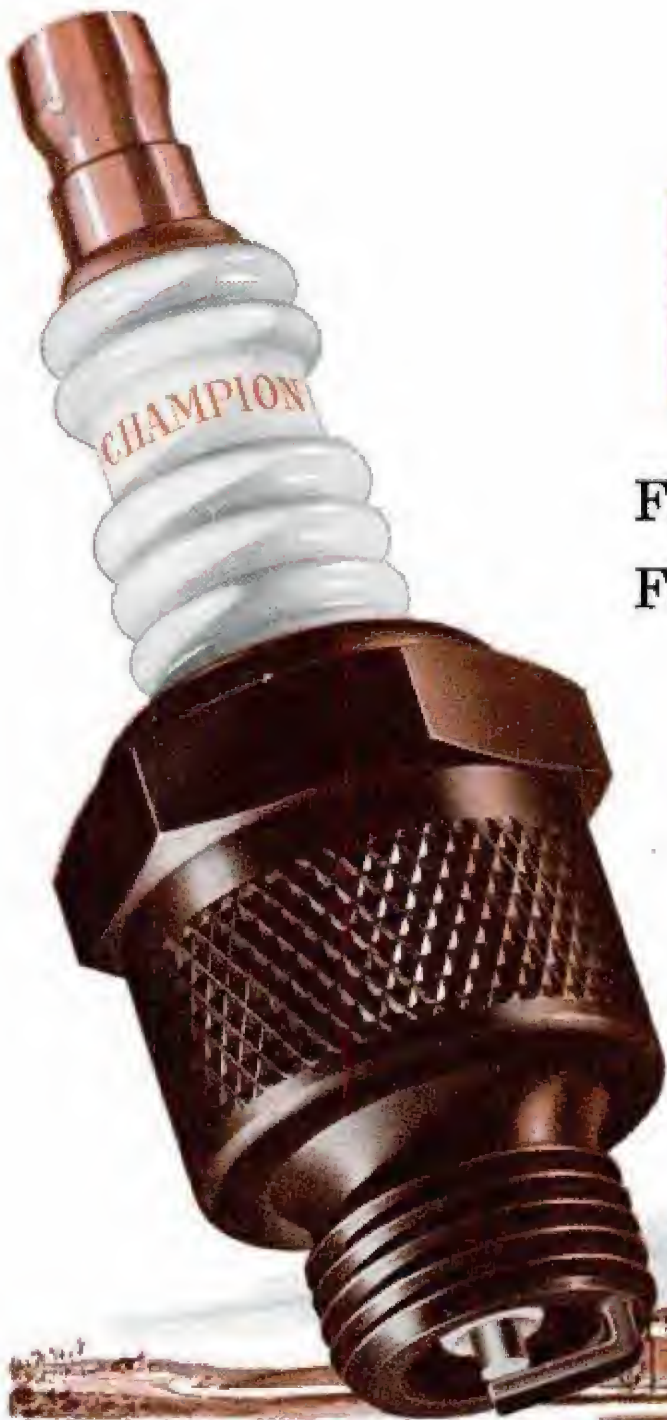
Follow recommendations of plug types and fuels approved by engine manufacturer.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, O.

Dependable

CHAMPION

First Choice in Spark Plugs
For Over a Quarter Century



BE A CHAMPION DRIVER

... It's Schoolltime Again—Be Extra Cautious!



"School" signs call for extra caution. Stop for children boarding or unloading from school buses; watch for them getting in or out of private cars, crossing streets!



Obey Safety Patrol boys. These youngsters save hundreds of lives and shoulder a great responsibility. They need your cooperation in observing signals.



Safe driving depends in great measure on a quick, responsive engine. That's why champion drivers everywhere have stamped Champion as America's Favorite!

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Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

BIG WORK SAWED, SANDED, DRILLED, TURNED—WITH HAIRLINE ACCURACY

**Rugged, Multi-Purpose
SHOPSMITH is complete
power workshop in one
compact unit**

61,000 SHOPSMITH owners wholeheartedly agree—you can't beat SHOPSMITH for accuracy, capacity, all-around utility. It does the work of *five* heavy-duty single-purpose tools—actually does it *better*.

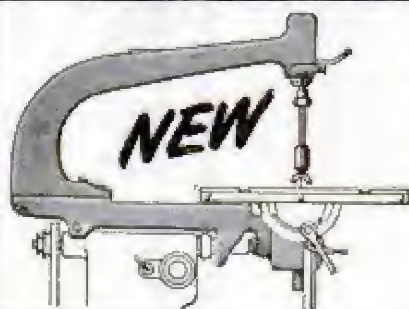
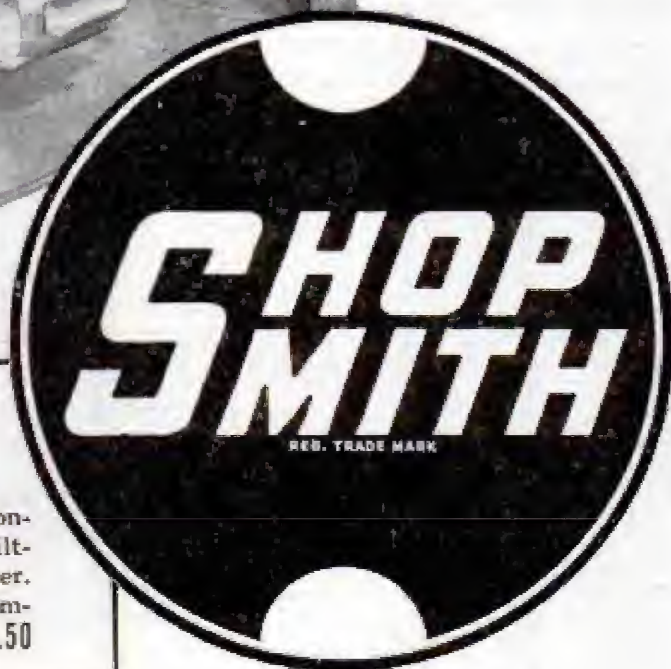
SHOPSMITH has precision features found only in highest priced saws, drill presses, lathes and sanders. Four grease-sealed ball bearings in headstock. Induction hardened spindle tip. Centerless ground steel ways. Built-in quality through and through. So compact it fits any 2' x 5' space. So ingeniously engineered you can convert from tool to tool *in less than 60 seconds*.

Takes all standard accessories including shaper-cutters, drum sander, jointer fence and cutter, flexible shaft, dado heads, etc. See SHOPSMITH demonstrated at any Montgomery Ward, leading hardware or department store. And write for *free* 16-page booklet.



\$169.50

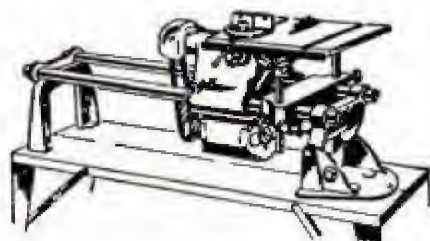
complete except for motor.
With special ½-hp., ball-
bearing, capacitor-type motor
(shown) **\$199.50**



JIGSAW for SHOPSMITH

Heavy-duty, precision construction. 18" throat. Tilting table. Built-in blower. Attaches quickly. Price complete..... **\$34.50**

1. 8" CIRCULAR SAW

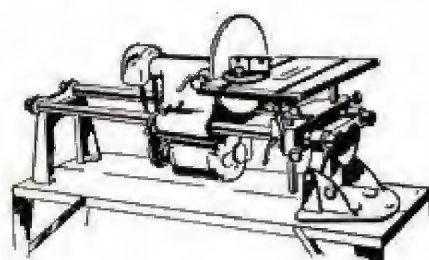


SHOPS MITH saw has capacity and performance equal to or greater than most cabinet shop models. Can cut to center of 8' plywood panels. Effective table width up to 56". Depth

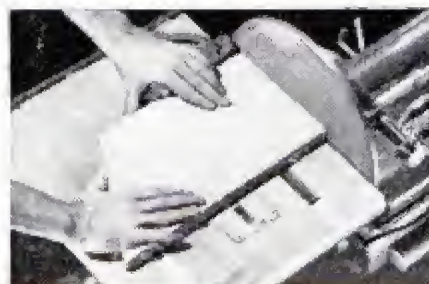


of cut 2 1/4". Sturdy tilting table with ball-crank raiser for precise settings. Precision-tooled miter gauge and self-aligning rip fence.

2. 12" DISC SANDER

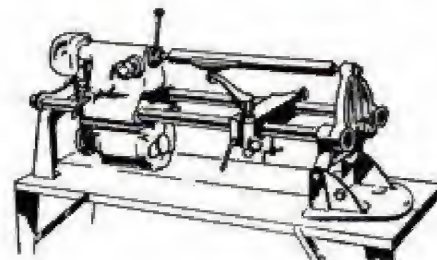


With extendable quill, 12" cast-aluminum disc can be fed into workpiece for safety and accuracy. Extra-large adjustable table measures 14 1/2" x 17". Use miter gauge for accurate



squaring and mitering; rip fence for super-smooth jointing; tilting table for compound-angle sanding. Operator can face work or work from side.

3. 33" WOOD LATHE

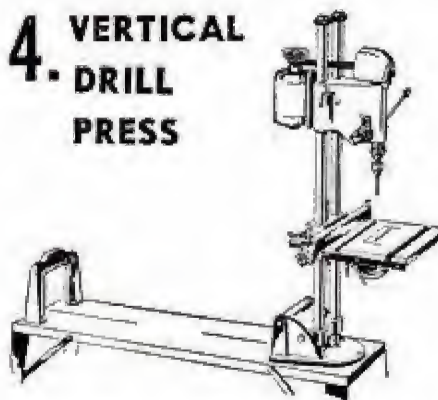


Greater capacity than most other heavy-duty lathes. 15" swing. 33" between centers. 4" quill feed. Swivel-arm tool rest always parallel to ways —no need for constant adjusting.



Quickly adaptable for face plate work. Fine-grain cast-iron headstock slides with fingertip pressure, locks in any position.

4. VERTICAL DRILL PRESS

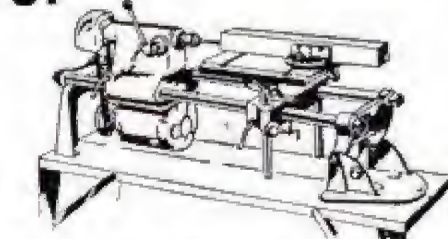


SHOPS MITH drills to center of 15" circle, has a maximum clearance table to chuck of 27". floor to chuck of 55". Jacobs key chuck takes straight shank drills from 5/64" to 1/2" diameter.



Rugged, 6-spline spindle floats on 4 lifelong, grease-sealed ball bearings. 4" quill feed. Lever fits either side of driving head for right- or left-hand operation. Speeds from 875 to 3500 rpm. Use with or without fence.

5. HORIZONTAL DRILL



Extremely useful operation possible only with SHOPS MITH. Quill feed up to 4" with adjustable stops. Permits large, heavy pieces to be drilled or mortised quickly, accurately. Handy,



too, for doweling tops for tables. Miter gauge and fence eliminate need for jigs. 36" effective table support. Length of work limited only by size of room.

SHOPS MITH TAKES ALL STANDARD ACCESSORIES



Fact-packed, 16-page illustrated booklet. Send for it!

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There are lots of "fussy fix-it" jobs around the house that Dad, Mom or the kids can easily do when Channellock pliers are handy. No matter what—electrical, automotive, plumbing, battery, or anything mechanical—you need Channellock pliers.

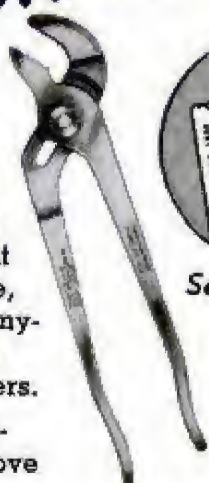
Channellock's patented tongue and groove joint gives you these "plus" features: Greater Strength, Longer Wearing, Self-Cleaning, Closely-spaced Adjustments, Visible Adjustment, No Wear on Joint Bolt.

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MEADVILLE, PA.



Over 100

CHAN NEL LOCK



Send for Catalog
C-14 today.

Revolution of the Free-Piston Engine

(Continued from page 118)

now. The Pennsylvania locomotive will operate on diesel oil. Preliminary estimates indicate that it will be, by a wide margin, the most efficient locomotive ever built. The most immediate application of the idea is in the compressor fields—for instance pushing gas through pipe lines now spreading over the country. Compressors must be spaced every few miles along the network to push billions upon billions of cubic feet of gas through the lines. From present evidence, the free-piston engine is ideal for this use. It would operate as the air compressors worked on German submarines. The machines would feed on the fuel they were pumping. They would burn gas at the center of the cylinder, compress it at the ends. There would be no turbine in such a setup—the free-piston engine would spend all its energy compressing gas, pushing it through the pipe-line network.

Several major truck and bus companies see the free-piston engine as the solution to some of their greatest problems. For all practical purposes the 300-horsepower engine seems to be about the upper limit for trucks and busses. Beyond this point gears and transmissions become too heavy. And with the massive trucks now on highways, a 300-horsepower engine isn't powerful enough to get them up hills without stalling long lines of traffic behind them. In addition, time lost on hills increases costs to bus and truck operators.

Since a free-piston engine requires no conventional transmissions—it would be connected to wheels with a hydraulic coupling—there is no upper limit to its size. It has, in effect, all the flexibility of the old steam auto engine without that engine's greatest drawback. It doesn't blow up. As more fuel is shot into the cylinder the pistons are driven farther apart, developing greater compression and more power. A truck with a free-piston engine could make a jack rabbit start at a traffic light, getting away as fast as a motorcycle.

Applications to automobiles appear to be well in the future, but such applications have dazzling appeal. A free-piston engine would be unbelievably quiet and vibrationless. It would be so small that it could be placed anywhere in a car and so economical that it would give 50 to 60 miles per gallon of fuel—diesel oil or kerosene. It also has drawbacks. First, the great U. S. auto industry has hundreds of millions of dollars invested in engine plants and would be hesitant about scrapping them to build a revolutionary new engine, no matter how

(Continued to page 250)

Delta long-life quality features:

- Pre-loaded ball bearings.
- Precision-ground arbor.
- Precision-bored bearing seats.
- Ball bearings are lubricated for life.

No. 34-405

\$234⁰⁰

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without notice)

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Low down-payments, easy terms

Delta is the *complete* line;
53 machines — 246 models.
Over 1300 accessories.
Plus a complete line of
14 Homecraft® machines.

DELTA
MILWAUKEE
®

More saw for the money!

Compare what you get!

- ✓ Double-faced rip fence — locks front and back.
- ✓ Exclusive Auto-set miter gage.
- ✓ $\frac{3}{8}$ " arbor.
- ✓ Diameter of saw blade, 10".
- ✓ Blade tilts 45°.
- ✓ Cross-cut capacity, 12".
- ✓ 3-belt Texrope drive.
- ✓ Graduated front guide bar.
- ✓ Fence can be used on either side of blade.

Famous Delta Unisaw®

Compare this rugged 10" tilting-arbor saw alongside *any* saw *anywhere near* its price. Then you can see why the Delta Unisaw is first choice of schools, industry, commercial shops, home shops.

It's got big capacity — rips to center of 50" panel, cuts stock up to 3 $\frac{1}{8}$ " thick. It has heavily-ribbed cast-iron table, 36" x 27", with ground surface; massive, smooth-operating trunnions; steel cabinet base. It's safe and convenient — has saw guard that really protects . . . fast, handy controls.

See the Delta Unisaw in operation today. See why it's more saw for the money.



Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

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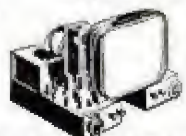
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good. Further, thousands of garage mechanics are trained to service traditional engines and might have a hard time learning a new art.

Engineers think that on a real mass-production basis free-piston engines would cost far less than engines in use today. They would solve the service problem by eliminating service. If mechanical difficulties arose a car owner would drive to a garage, trade the ailing engine in on a new one or a factory-rebuilt job. This idea has been gradually creeping up on the auto industry. Today, we exchange faulty carburetors, generators, timers and other engine parts. Tomorrow, a mechanic may simply hoist out an old engine and bolt a new one into place in a few minutes.

Today, many aircraft engineers think free-piston machinery will pick up where the jets leave off. Present-day jets appear to be reaching the upper limits of their effectiveness. For one thing, their efficiency is directly related to the temperature at which they operate. The problem is to get metals for turbine blades which will withstand the inferno heat from the combustor. Right now, metallurgists feel that they have about reached the peak at 1800 degrees Fahrenheit.

The free-piston engine, on the other hand, operates at temperatures which power plants have used in steam turbines for some time—around 1000 degrees Fahrenheit. Metals which will operate at this temperature and give years of faithful service are readily available.

This low temperature in free-piston machinery is accounted for by several things. At the moment of explosion the temperature is about what it is in other internal-combustion engines—around 3000 degrees. But as explosive gases expand they lose heat rapidly. Further cooling is achieved by compressed air from the outward stroke of pistons.

For these various reasons, there is no road block in the way of applying the free-piston engine to aircraft. Its high efficiency—nearly double that of the best jets—would be translated into greater range, greater fuel economy. Its light weight and fuel economy would give it a tremendous advantage over traditional radial engines. Potentially, at least, it opens the way for world plane travel cheap enough to be within almost everyone's reach.

Free-piston machinery should find application wherever power is needed. It compresses air for drilling machinery, and can provide energy to move gas through pipe lines. It would be an ideal machine for giant shovels and other earth-moving

(Continued to page 252)

"MY CAR'S GOT TWO MUFFLERS?"



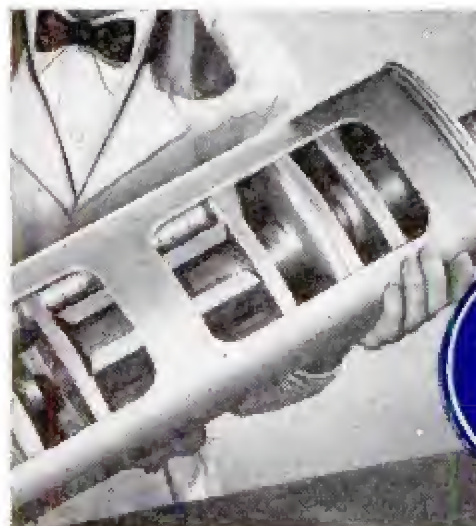
"I'M PUTTING TWO MUFFLERS ON YOUR CAR," THE MECHANIC TOLD ME. "TWO?" I SAID, "ALL I SEE IS ONE!"



HE EXPLAINED THAT THE GENUINE FORD MUFFLER HAS TWO SKINS FOR EXTRA QUIET AND LONGER LIFE...



AND HE TOLD ME IT HAS SAFETY-LOCKED SEAMS, TOO, AT BOTH ENDS TO ELIMINATE GAS SEEPAGE.



ITS FREE-FLOW DESIGN GIVES BETTER GAS MILEAGE. IT'S THE LOWEST COST QUALITY MUFFLER WITH THESE QUIET, SAFETY, LONG-LIFE FEATURES.



YOU'LL FIND IT'S THE SAME WITH ALL GENUINE FORD PARTS. THEY'RE BUILT TO SAVE TIME, MONEY AND MEAN REAL SATISFACTION

AVAILABLE WHEREVER YOU SEE THIS SIGN AT ALL FORD DEALERS AND SELECTED INDEPENDENT GARAGES

KEEP YOUR FORD

ALL FORD!



Stuck up?



Cleaned up!

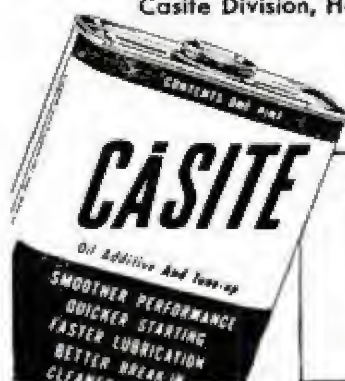


CASITE *Frees* STICKY VALVES

Get rid of engine coughs, jerks, roughness. Chances are, it's caused by sluggish or sticky valves.

Casite through the air-intake quickly frees sticky valves, lets the engine *breathe*, lets the power zoom through. A second pint of Casite, in the crankcase, keeps the engine clean and free-running. Cuts engine wear by speeding lubrication... Get a Casite Treatment for your car today from your garage, service station or car dealer.

THE CASITE CORPORATION • HASTINGS, MICHIGAN
Casite Division, Hastings Ltd., Toronto



75¢ A PINT
95¢ in Canada

BETTER AND SMOOTHER
PERFORMANCE OR
*double-your-
money-back*

equipment. Engineers have rough designs for a compact outboard motor. The torpedo-shaped power unit rides under the water, eliminating the noise that makes this type of engine a nuisance to people who live along rivers and lakes. The engine develops 20 horsepower, weighs 80 pounds.

In the power field, the new engine offers more economical production of electricity—a saving which will be passed along to consumers in lowered electric bills. It should chalk up savings on a number of scores. First, it is light, vibration-free. Hence, it requires no heavy foundations.

Free-piston machinery has another advantage in the power field. Fuel markets fluctuate constantly—strikes shut off coal, winter cold spells strain natural gas, war creates petroleum shortages. The engineers contend that any power plant built today should be designed to operate on any fuel. Free-piston machinery answers this requirement. Equipped with a gas generator, it can operate on coal. It can be designed to use natural gas or any of the light oils.

The free-piston engine will find greatest usefulness in the power field in medium-size cities. These engines could be used up to 25,000 horsepower. Giant steam-turbine plants are firmly entrenched above 50,000. Present engineering data indicate that 5000 horsepower may be the upper limit for a single-cylinder engine. Multiple-cylinder units will take care of power requirements above this point.

In sum, there is hardly a place where fuel is converted into energy that the new engine won't find application. It is more versatile than the diesel, three times more economical than the open-cycle gas turbine, cheaper than the steam plant. Prophecy is never completely safe with any development as new as this. But everything indicates that the free-piston engine will have quite as large an impact on all our lives in the second half of the 20th Century as the conventional internal-combustion engine had during the first half.

Cold-Weather Antidote

Survival time in cold weather is increased 54 percent by dosage of a thyroid compound called endothyrin. Army and civilian researchers found that when thyroid activity was suppressed with doses of another chemical, thiouracil, larger numbers of the animals used in the test died and they died sooner. A dose that raised the basal metabolic rate by 30 to 50 percent was found to be most effective. Given orally the compound took four to five days to produce the cold-resisting effect, while it acted within eight hours when given by injection.

**GROBAN'S
BRAND NEW**

WAR SURPLUS BARGAINS

**ALL FULLY
GUARANTEED**

LOGAN HEAVY DUTY

HYDRAULIC PUMP

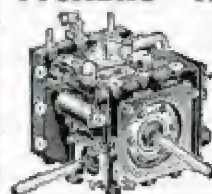
For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has a 3/4" inlet, 1/2" outlet, 3/4" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 23 lbs. Overall dimen.: 7" L x 3 1/2" H x 3 1/2" W. A \$105.00 value. **FOR ONLY.....**
F.O.B. Chicago



(ITEM #29)

22.50

VICKERS HYDRAULIC TRANSMISSION



MODEL AA18801A
Ideal for lathe drive, miniature cars, power machinery, gearing, etc. Rated 2 HP maximum input at 3150 RPM. Output speed continuously variable from 0 to 1/2 of input speed in either direction. Self contained reservoir. All controls external. Even power at all speeds. Complete with two 1/2" shafts with flat for pulley attachment. Ship. wt. 20 lbs.
Gov't acquisition cost \$325.00.
A tremendous value at.....
F.O.B. Chicago
(ITEM #85)

25.00

HYDRAULIC CONTROL VALVES

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A \$38.00 value
postpaid.....
7.95
ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A \$60 value.....postpaid
10.95



(ITEM #24)

Hydraulic Cylinders-Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arborers, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.
ITEM #24—All steel double action hydraulic cylinder, 1 1/2" bore, 27" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Ship. wt. 4 lbs. F.O.B. Chicago.....
4.95

ITEM #33C—Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. Postpaid.....
8.95

ITEM #32—Double action, 1 1/2" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A \$45.00 value. Postpaid.....
10.95

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base end of shaft. Overall length closed 12 1/2". Has 3/4" stainless steel shaft. Uses 1/4" tubing fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Weight 7 lbs. Postpaid.....
12.50

ITEM #16—Double acting cylinder, 1 1/2" bore, 27" stroke. Will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 8 lbs. A \$55.00 hydraulic cylinder value for only Postpaid.....
12.95

ITEM #15—Double acting cylinder, 3" bore, 10 1/2" stroke. All steel hydraulic cylinder, will lift up to 7000 lbs. with 1000 P.S.I. line pressure. Wt. 12 lbs. A \$78.00 value. Postpaid.....
19.50

ITEM #42—Double action, 3 1/4" bore, 20" stroke. Rated lift capacity 8800 lbs. with 1000 P.S.I. line pressure. Clevis mounting, aluminum alloy barrel with 1 1/2" stainless steel shaft and piston. Wt. 20 lbs. A \$125.00 value. F.O.B. Chicago.....
25.00

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. line pressure is 12,560 lbs. Ship. wt. 30 lbs. AN EXCELLENT VALUE for.....
32.50

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for 3/8" pipe and 50c ea. for 1/2" pipe.

UTILITY PUMP ROTARY VANE TYPE

Perfect For Water, Oil or Insecticides

Sprays DDT, 2-4D, sulphur compounds, etc. Pressures to 150 lbs., 15 gals. per min. at 1200 RPM using 2 HP. As vacuum pump for milking machines, lab use, etc., delivers 25" vacuum, 4.5 cu. ft. per min. at 1600 RPM using 3/4 HP. Rotate either direction, 1/2" pipe fittings, 1/2" standard shaft, 4 ball bearings. Easy to mount—ready to run. Ship. wt. 13 lbs. (ITEM #51) F.O.B. Chicago



(ITEM #51)

16.50

G-1 STAINLESS STEEL TANK

Use these tanks on compressors, for tire inflators, pulsation chambers, floats, buoys, hydraulic reservoirs, fluid and milk containers, fuel containers, etc. Tough, light, shatterproof. 450 P.S.I. Aviator's Breathing Oxygen bottles, type G-1, 2100 cu. in. (approx. 9 gallons) int. vol. 24"x12". 3/4" threaded openings at ea. end. Wt. 10 lbs. (ITEM #63) Price.....
F.O.B. Chicago



(ITEM #63)

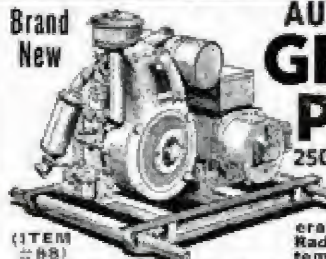
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FREE: 44 PAGE CATALOG—Full of unsurpassed War Surplus "buys" including generators, pumps, welders, double action hydraulic cylinders, control valves, tanks, pumps, hose, fittings and data on hydraulic applications. Write today!

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AUXILIARY ELECTRIC A.C. GENERATING PLANT

FOR GENERAL UTILITY AND EMERGENCY USE
2500 WATTS - 115 VOLTS A.C. 60 CYCLES

Plenty of current to operate your: Oil Burner, Sump Pump, Refrigerator, Home Freezer, Power Saw, Lights, Radio and Television, Home Water System Pumps.

Complete integrated heavy duty electric power plant. Signal Corps Model PE-75, driven by Briggs & Stratton, one cylinder 0 1/2 H.P. Model ZF, 4-cycle engine with killer button, oil bath air cleaner, governor, muffler, starting rope, and radio interference filter. The self-excited Leland or Westinghouse generator is rated 2500 Watts, 115 Volts, 60 Cycle A.C. single phase, belt driven, with guard and duplex receptacle. When generator is not in use, you can use the engine separately to power other equipment. Mounted on adjustable steel skids, notched for carrying poles. Net wt. 310 lbs. Ship. wt. 440 lbs. Dimen. 86"x19 1/2"x24", 12 month guarantee. \$726.00 value.....**NOW**
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295.00

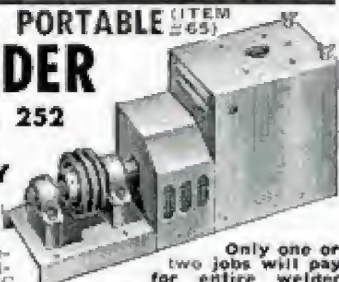
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250 AMPS. MODEL 252

FOR ANY WELDING JOB, LIGHT OR HEAVY

Stop Costly Repair Bills, Weld It Yourself and Save



Only one or two jobs will pay for entire welder

Designed for many years of trouble-free service. This precision engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly when and where you need it. Has dial type rheostat for easy manual control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor, a 7 1/2 HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley). Now.....**AT A FRACTION OF ITS VALUE**. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs.
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99.50

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp and 3 lbs. of assorted welding rods. (ITEM #66) Ship. wt. 17 lbs. F.O.B. Chicago.....
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IF MORE INFORMATION IS DESIRED, write for WELDER CIRCULAR.

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SURPLUS SPECIAL! CONTINENTAL RED SEAL 1 1/2 H.P. ENGINE

1 cylinder, 4 cycle gas engine with 6:1 gear reducer for 300 to 400 RPM output.

● For Lawn Mowers, Garden Tractors, Light Farm Machinery, Feed Mills.

● To drive Pumps, Compressors, Generators.

Engine rated 1800 to 2400 RPM, complete with starter rope, muffler, oil bath air cleaner. \$74.00 value. Ship. wt. 60 lbs. **NOW.....WHILE THEY LAST.....**
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39.50

EMERGENCY ELECTRICITY!

750 WATT • 115 VOLT • 60 CYCLE

A.C. LIGHT PLANT

USE FOR: Home lighting, trailers, tourist cabins, hunting lodges, fire truck lighting, emergency standby units. Plenty of power for home freezer, oil burners, incubator, radio or lights. **GENERATOR:** Manufactured by Eleor, rated 750 Watts, 115 Volts A.C., 60 cycles at 1800 R.P.M. Complete with volt meter regulator, \$249.00 value. (ITEM #86) These generators built to exacting Signal Corps specifications, are the answer to your lighting needs. **GASOLINE ENGINE:** Briggs & Stratton, Model BP, 3 H.P., 1800 R.P.M. Completely radio shielded, full accessories including air cleaner, muffler, starting rope, killer button, remote control wire. Ship. wt. 165 lbs. Complete unit, \$249.00 value. **NOW ONLY.....**
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139.00

DIRECT CURRENT GENERATORS



For welders, plating, truck and marine use. D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

ITEM #89—Type M-2, rated 50 Amps.—24 Volts. Mfd. by Leeco-Neville Co. Ship. wt. 22 lbs. Gov't. Acq. Cost \$176.00. F.O.B. Chicago **NOW ONLY**
16.50

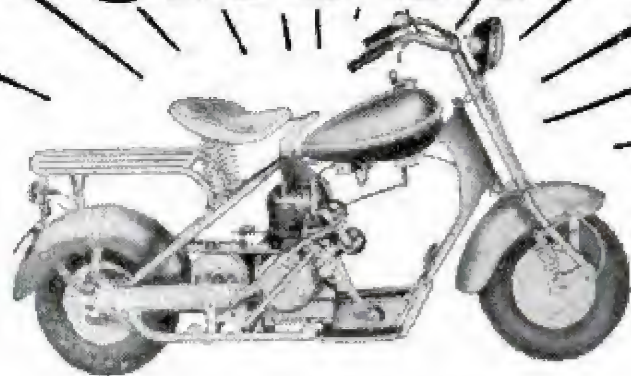
ITEM #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost \$300.00. Ship. wt. 70 lbs. F.O.B. Chicago.....
22.50

ITEM #91—Type P-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz, Gov't. Acq. Cost \$380.00. Ship. wt. 70 lbs. F.O.B. Chicago.....
35.00

Each individually packed in wooden box.

Announcing the New CUSHMAN

EAGLE



The sensational New Cushman EAGLE is ready! And, Boy! O Boy!—how you'll enjoy this entirely new thrill in motoring pleasure! It's big, husky, powerful, speedy! Has you moving at high speed within yards! Cruises up to 50 miles an hour out on the open road! Amazing fuel economy—up to 75 miles to the gallon! Luxurious comfort—big motor-bike saddle seat mounted on double coil springs . . . shock-absorbing springs on front wheel . . . big balloon tires designed for comfortable riding as well as easy steering and long life. Powerful 2-wheel brakes. 2-gallon (plus) fuel tank. Brilliant headlight, tail-light. Nothing else like it—and it's yours for only \$282.50 f.o.b. factory.



Long-time favorite for lowest cost motoring! Thousands in use. Cheaper than bus fare or operating your car. Handles easy. Slips through traffic, parks anywhere. Wonderful for getting to work, school or market—making deliveries. Famous Husky engine.

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See your Cushman dealer for the New EAGLE and regular Cushman Scooter. Or send for Folder M9.



85
MILES
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Rider Agent Plan
Available

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CUSHMAN MOTOR WORKS, Inc.
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10 SHELF PLANS

NEW FULL SIZE

New, full size, easily built, beautiful wall shelf plans ready to trace on lumber, cut out and assemble. Corner and wall racks with 1 to 3 shelves. Stores charge about \$75.00 for these shelves. Make money selling them. Finest selection available. PLUS BONUS of 48 other novel cut-outs, Dutch Boys, Girls, Toys, etc., etc. PLUS FREE latest Handicraft Catalog. Send only \$1 to



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RACINE, WIS.

I Flew Thirty-One Hours in a B-36

(Continued from page 102)

from outside the ship, furnished by power units similar to those which run contracting equipment. Use of external power adds to the pay load of the B-36 by eliminating the weight of the power unit.

The ground crew chief plugged this starter into the electric system, cleared the propellers of obstructions and reported symptoms of engine performance in starting.

He also directed the parking of fire engines near the mammoth power plants as a precaution against fires. The hand equipment which stands by at starting of engines of other planes could not effectively reach a fire in the lofty engines of a B-36.

Soon the words "starting number six" were heard, a rather startling announcement when you are used to flying planes with only four, or even two, "fans."

After a run-up period, number five was started, and the others in order until all six of the three-bladed props were spinning. The pitch of the blades was checked carefully during the hour-long testing of controls, switches and synchronization.

If one or more propellers should be in reverse pitch on take-off, that is, in a position to hold back rather than push the plane, the big aircraft might drop off on one side and crash with full power applied.

This precaution taken, we taxied out to take-off position. With wings stretching 120 feet to either side, we had to avoid narrow taxi strips and virtually weave our way between other parked planes.

The pilot has a simpler job of steering a B-36 on the ground than in most other planes. He does not use his regular controls, but turns to a special nose steering wheel much like those in city busses.

Just at dark, everyone buckled into position as the pilot called a readiness warning on the interphone. Seconds later the giant engines roared to full power as two pilots held back on the brakes.

Greater and greater became the surge as the 130-ton titan struggled against the brakes. Then suddenly pressure was released and we charged down the runway.

Before half the runway was used we were airborne and climbing much faster than we did in Superforts. Within a mile we were well aloft as our landing gear stowed itself amid the opening and folding of wheel-well panels.

Once out of the Fairfield traffic pattern, we headed south between the coastal mountain ranges and the Sierras. We stayed low as long as possible before turning east to climb over the mountains.

(Continued to page 256)

SAVE UP TO 60%! GIGANTIC MAIL SALE! **COMPLETE BARGAIN CATALOG**
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Power Plants • Welders • Pumps • Compressors • Tools

WE PAY SHIPPING COSTS

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A-C POWER PLANTS

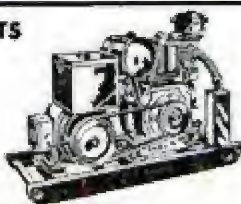
Brand New
110-volt, 60-cycle
2500-watt
Army's finest plant,
ideal farmers, camps,
contractors, etc.

• Briggs 8.5 h.p. engine, Leland generator.

• Full kit spare parts, tools, instructions.

• Cost over \$700.00

SALE \$279.00



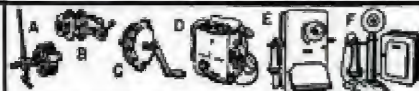
PORTABLE AIR UNIT

Briggs 1.5 h.p. engine, Bendix 2 cyl. ball bearing \$104.00 compressor in portable wheeled frame. Comes with hose, gauge, regulator, valves, unloader, tire chuck, instructions. Over 4.5 c.f.m. Pressures to 125 lbs. Excellent for farms, painters, shops, contractors.

• Slightly used. Factory rebuilt. Like new.

• Cost over \$275.00

SALE \$99.50



MISCELLANEOUS BARGAINS

"We pay Shipping Costs on everything"

A. Utility Clutch up to 6.5 h.p. \$13.95

B. V-belt Clutch up to 1.5 h.p. \$ 7.49

C. Hand Gas Pump 10 g.p.m. \$13.90

D. Army Field Telephone EE-8 \$11.25

E. Rural Phones (1600 ohm 5-bar) \$12.40

F. City Desk Phones (Com. Batt.) \$ 4.99

G. Navy-Type Binoculars 7x50 \$39.00

H. Complete 110-volt Water System \$50.50

AIR COMPRESSOR KIT

Assemble own unit. Consists of finest one cyl. piston compressor (see below), stainless steel 2100 cu. in. tank, 160 lb. gauge, safety valve, paint spray gun, blow gun, 15 ft. hose, assembly instructions, tire chuck, fittings. Drive with engine or motor. \$80.00 Value

(Brand New) **SALE \$36.90**



Quincy One-Cyl. Compressor

Top quality. 150 lbs. pressure, 2.68 c.f.m. \$25.00 Value

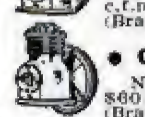
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Quincy Two-Cyl. Compressor

Nation's best. 150 lb. up to 9 c.f.m. \$60.00 Value

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D-C WELDING GENERATOR

Outstanding Welding Generator. 0 to 250 amperes. Easy to drive with tractor, engine, etc. Complete welding unit with helmet, holders, cables, rods, etc.

Cost over \$250.00 (Brand New)

SALE \$104.50



WATER PUMPS

Genuine New Burdex Bronze self-priming all-purpose water pumps. Lift water up to 25 ft. Pressures to 60 lbs. Up to 22 g.p.m.



1/2" Model..... **\$12.79**

3/4" Model..... **\$15.99**

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3/4" Aqua Centrifugal..... **\$6.50**



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Cost over \$150.00 (New) **SALE \$21.95**

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\$300 to \$500 EXTRA PROFIT MONTHLY with ARC WELDING

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EASY... PAY OUT OF PROFITS TERMS as low as \$12 monthly

GAS DRIVE combination A-C Welder and A-C Power Unit. Actually two machines in one. Change from welder to power unit by flip of switch. Lets you cash in on high pay emergency service and many important repair jobs. Ask Hobart how easy you can start a welding business of your own. Free book.



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THAT YOU CAN BUY LAND WHOLESALE \$3 to \$5 acre full price —

Farm, Timber, Ranch Lands in California, Oregon and Washington. Send 10c for prices, photos, full information about amazing buys YOU can make.

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NEW SELF-DRIVE B-M POWER MOWER!

For Modern Lawn Care

Why waste energy pushing a Power Mower when a new self-propelled B-M Mower can be had at our low factory cost? Available in 20" or 22" sizes with 2 or 3 h.p. Clinton engines. Send for our FREE literature showing four models in three sizes including the new direct blade drive with vertical shaft motor. Prompt shipment.



MODEL PD1

LOW FACTORY PRICE

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Make all your tools more useful with a DESMOND-SIMPLEX VISE

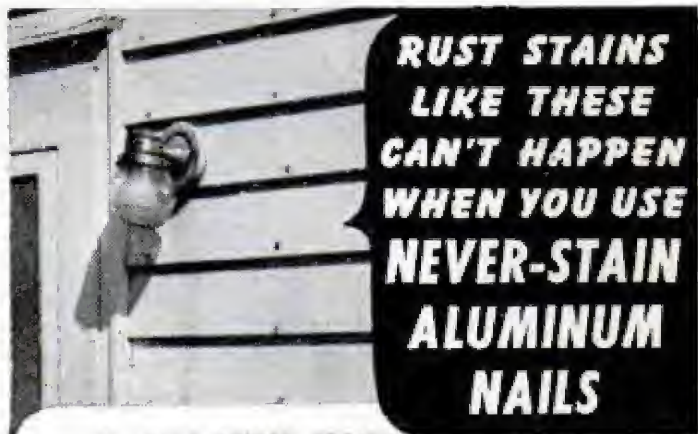


Enclosed Screw . . . Steel Channel Slide

Here's your best vise value by far. And at a surprisingly low price. Steel slide encloses screw; prevents damage from falling chips. Swivel base for maximum convenience. Non-pinch type handle. Pipe jaws part of vise. Replaceable hardened steel jaw inserts fit snugly on heavy shoulder, withstand heaviest blows from any angle. Hardened steel cut-off tool on anvil. Get a Desmond-Simplex Vise from your hardware store. Write us direct for valuable folder on your basic shop tool.

The Desmond-Stephan Mfg. Co.

Walnut Street, Urbana, Ohio



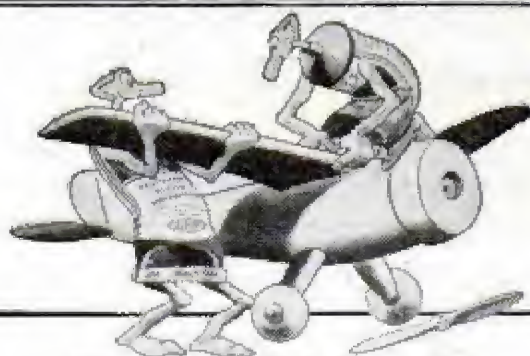
- ★ WILL NEVER STAIN OR STREAK PAINTED SIDING OR COLORFUL ROOFING
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- ★ ALMOST 3 TIMES AS MANY PER LB.

They pay for themselves in the savings they make—and they may save you a \$300 repaint job! Now packaged for the job in different colored boxes, each with quantity, size and type clearly indicated.

THERE IS NO SUBSTITUTE FOR ALUMINUM!

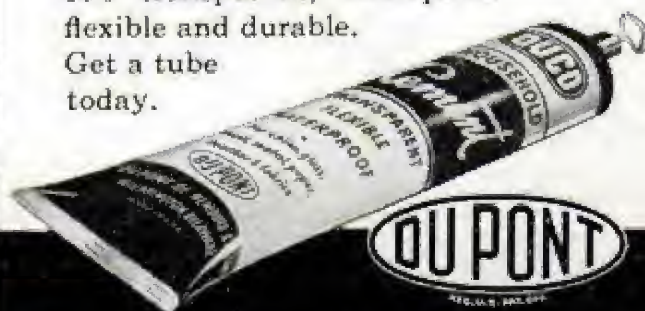
Write for FREE Samples.
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BUILD STRONGER MODELS

It's transparent, waterproof
flexible and durable.
Get a tube
today.



DUPO CEMENT

REG. U. S. PAT. OFF.

Each hour at low altitude meant a lighter load to be lifted when it came time to climb. Had we been flying out over the Pacific, chances are we'd have stayed on the deck for many hours before calling on the big bird to produce the extra energy to get "way up in the blue."

This phase of planning comes under the jurisdiction of the flight engineer, whose position is truly important in that he has complete charge over the power plants and the many smaller motors and controls necessary to its performance.

The pilot is relieved of much of the important responsibility of engineering problems. Much as aboard ship, the power plants are separated from the piloting and navigating problems.

These technicians figure in such details as fuel-consumption variation, the weight of the plane at any given time, its changing center of gravity and its effect on performance during various climb and descent phases. They predict how fuel will be used in future hours in each of the six engines, taking into account the varying weight of the plane as hours of flying use up gas. Each thousand gallons used lessens the weight by three tons.

Though we took off from California at dusk, it was already daylight by the time we roared over central Georgia, our engines throbbing with a peculiar beat typical of the B-36, often described as the sound of an outboard motor echoing across the lake.

We had zigzagged across the southwest and delta states performing certain phases of our mission during the night. The period of darkness was three hours shorter because we had flown east across three time zones.

Our tasks all fitted into the function of reconnaissance, which is charged with obtaining information of every possible kind with such accuracy that it can be used as basis for strategic bombardment.

The First Strategic Reconnaissance Squadron and its sister units will be airborne intelligence for Strategic Air Command and, in the event of emergency, will obtain information used to support strategic bombing.

These crews are training to fly solo to any target in the world to perform such tasks as photography, target study, feeling out of lines of communication, and weather analysis, all simultaneously.

By dawn we had accomplished several assignments and had shifted several times at controls and instruments. Most of us had

(Continued to page 258)



GET THIS 1950 CAR ENGINE PROTECTION

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FOR CONSTANT UPPER CYLINDER LUBRICATION

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The Power King #3001—built by Atlas—has many features of high-priced saws: tilt/arbor (table always flat), cuts $2\frac{1}{4}$ " deep, sealed ball bearings, precision-ground grey-iron table ($16" \times 25\frac{1}{2}"$ with two low-cost extensions), full length double-locking rip fence. You can't beat its value—see it today!



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Your projects can have the smartness of professional furniture with this Power King $4\frac{1}{2}"$ Ball Bearing Jointer-Planer in your shop. Saves you time and work in planing, rabbeting, tonguing, beveling. It's built extra heavy, with grey-iron base and table—precision-ground table surface—tilting fence—3-blade steel cutter head—plus other outstanding features. A good companion tool for your circular saw.

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stayed awake during our relief shifts, but now, after many hours, "sack time" had priority.

Our B-36 was equipped with two triple tiers of bunks, six in all, located aft of the bomb bays in the scanner-gunners' compartment. These had been assigned specifically to various crew positions by the plane commander; one for pilots, one for gunners, one for engineers, one for observers and so on.

To get to these, the tunnel from the nose compartment was in almost constant use. This tunnel, some 80-odd feet in length and 30 inches in diameter, connects the forward and aft compartments, crossing the length of the four bomb bays.

A cart similar to an auto-mechanic's dolly travels the length of the tube on rails. Its rider lies prone and pulls himself through on cables as in a horizontal dumb-waiter.

The two crew compartments were pressurized when the plane climbed two miles or more above sea level. At its designed altitude, air pressure is less than a quarter as dense as on the ground. If the cabins were not kept at relatively high pressure, the crews would have had to breathe pure oxygen for the entire time.

By using engine power to keep air pumped to nearly normal density, we did not have to wear oxygen masks constantly. We had no fear of bends, the disease so common to divers who have suddenly been zoomed from one pressure to one much less dense.

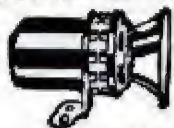
Such a possibility is always an added danger, for a "blister" or window might suddenly give way or be shot out. Such a gap would cause the more compressed air to rush for the opening, sweeping all loose objects in its way.

Should a man be caught in the tunnel at such a crisis, he would likely be blown through like a pea in a beanshooter. Safety hatches at both ends of the tunnel are a safety precaution against this possibility.

We all carried heavy flying clothing in case of such a blowout and in the event of failure of the heating system. Outside air temperature during the night dropped to 30 and 40 degrees below zero. However, no mishaps occurred and we worked with only flying suits over our uniforms.

As all servicemen are "chow hounds," off-duty time was also mealtime. Crew members carried up to five lunches apiece, including sandwiches, canned fruit, oranges, relishes, hard-boiled eggs, cakes and chocolate bars. These were supplemented by the milk, hot coffee and soups.

(Continued to page 260)

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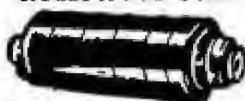
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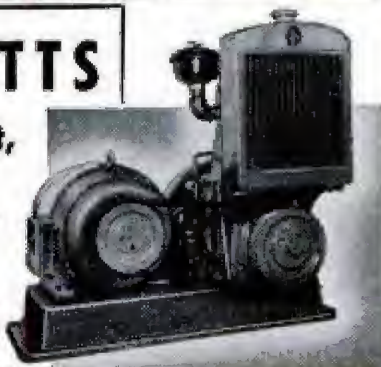
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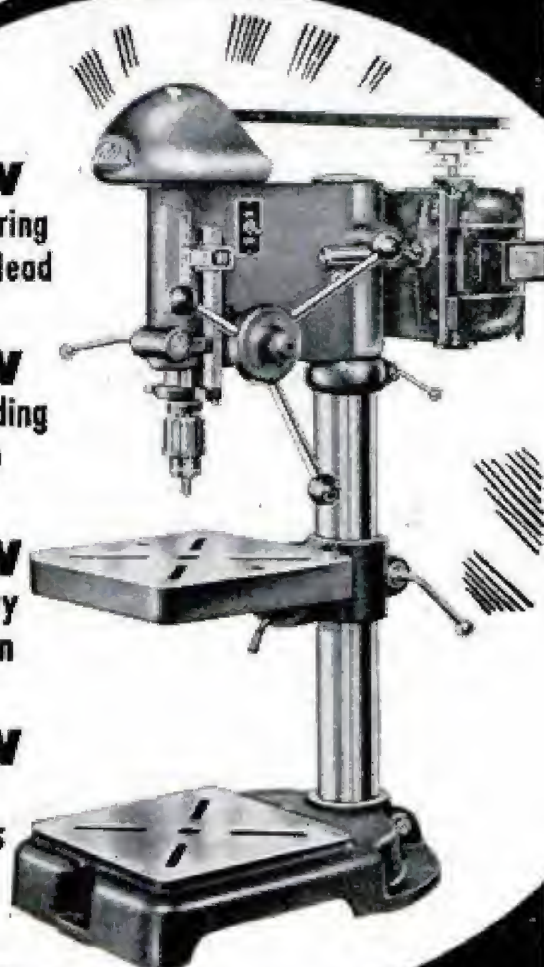
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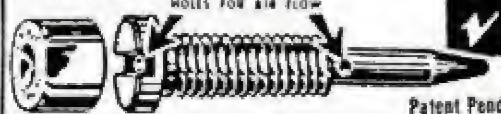
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Just mail card or coupon below and **TRY THEM FREE** for 10 days. Then check your mileage and engine performance. If satisfied, send only \$1.50 per needle (8 cyl. cars take 2). If not entirely satisfied—just return them and **YOU OWE US NOTHING—FAIR ENOUGH? TRY BEFORE YOU BUY**

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Hot cups to warm soup were plugged into several different outlets in our B-36. Steaming soups are always favorite fare among flight crews. In older types of planes, the crewmen used to warm the individual serving cans on radar sets and other hot electronic equipment.

Relief time was also wash-up time, and wash basins and reservoirs of water earmarked for the purpose were available both fore and aft. Nobody risked shaving amid the vibration and possibility of a sudden turn!

"Off time" was also visiting time, and crew members stopped by at other duty stations to watch goings-on and learn duties and problems of other specialists firsthand. Cross-training in the interests of teamwork is greatly encouraged on all "Sac" (Strategic Air Command) crews. Favorite spots for "goofing off" were the pilots' topside cockpit, the engineers' dome looking aft over the engines, the navigation section on the lower deck in the nose and the gunners' sighting stations in the strategically placed blisters fore and aft.

Our daylight photographic assignments brought us down to lower altitudes than the eight-mile altitude for which the B-36 was designed. We performed several photo-mapping projects in as many states, flying within a few hundred yards of a designated line for many miles in each instance.

The planners of the mission had calculated many hours before that we would be at each of these projects at certain times of day, even taking into account that on our way westward we'd have additional daylight for the more western assignments.

On several occasions other planes flew near us to look us over. Even in the Air Force the six-engined global bomber is a curiosity. In one case a fighter made several long-range "passes" at us, with the permission of our pilot.

Though his attacks were made when we were far below the altitude at which we would have been flying in the event of hostile attack, it afforded our gunners some practice in tracking incoming aircraft.

The B-36 is the most heavily armed aircraft ever to fly, all its heavy-bore guns being controlled from any one of several sighting positions, many yards from the guns themselves.

In case of attack, the gunners snap a few switches to raise the turrets from their normal stowage hatches inside the body of the plane. More circuits serve the sighting computers which aim, lead, fire and stow the turrets after use.

Strange as it might seem, the pilots did

(Continued to page 262)

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not have to use more strength to control our king-sized plane, despite the huge areas of aileron, elevator and rudder.

Though the cockpit controls moved in standard fashion, they did not directly move these broad surfaces but swung only small panels of these, and in the opposite direction from normal at that.

When the pilot wanted to move the rudder right, he swung his wheel over as usual. The effect was to move the trim tab panel to the left. The slip stream of air against this tab had a resulting effect of pushing the main surface over where the pilot wanted it to be. In all movements, the pilot really uses the slip-stream pressure to move his controls for him.

As we came closer to our home base, the power settings of the engines became less and less as the 60-odd tons of fuel were used up. The throb and noise of the propellers became more and more relaxed.

It was dark for the second time in the flight as we flew over Denver on our last project before turning home. It was past midnight when we finally set down again at Fairfield, 31 hours older than when we took off.

Our plane was more than 60 tons lighter than when we left and, even at a gross weight remaining of over 80 tons, practically "floated" in comparison with its original tendencies.

We were all glad the flight was nearing an end as the aircraft commander made his "final approach," touched down and reversed his props to slow us down almost to walking speed. We had landed and stopped in a shorter distance than many airliners a fraction of our size.

Though it was now 40 hours since we had reported for work, we were not yet through. It was nearly three more hours before we were dismissed to go home.

All performances of mechanical and electrical equipment had to be written up on maintenance reports. Our personal equipment had to be checked in, lunches and debris collected, cameras and film unloaded and other recording apparatus and technical equipment had to be processed. Then the crew had to be "debriefed."

Debriefing included all reports of the projects assigned and training accomplished, turning in of navigation and other logs, reports of unassigned and special observations and the crew commander's criticism of the mission as it was flown.

Then they let us go home with the promise of a day off—and a warning, "Remember, when you report back, you still have to vacuum-clean your compartments . . . no crumbs allowed."

Brighten Up!

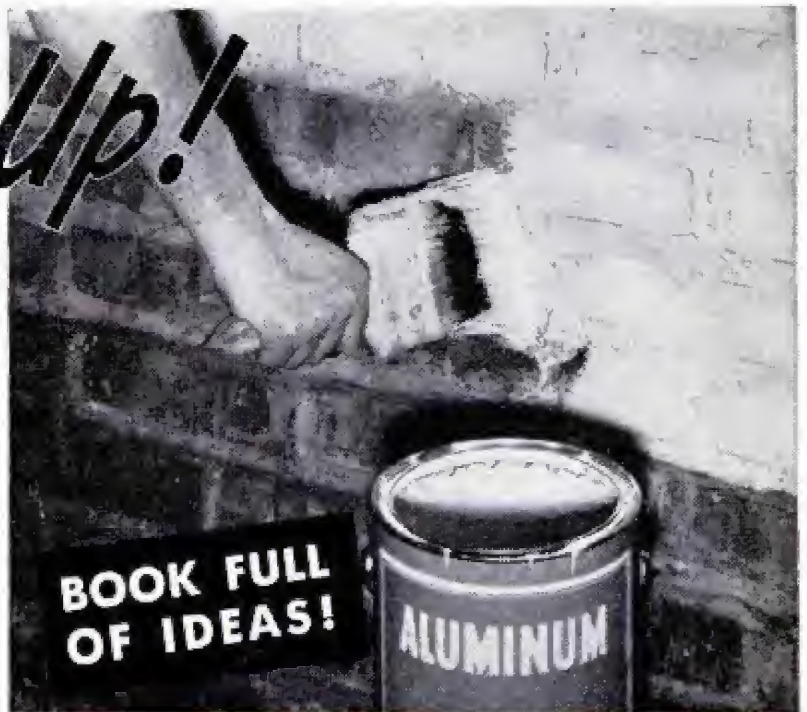
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Engine With a Built-in Tornado

(Continued from page 95)

would have happened if they had used a low-grade fuel like the light oil—20 numbers off—that the new engine laps up.

To understand what Barber did, you have to know what makes a standard engine knock. As a piston in your car moves down, air and fuel whoosh into the cylinder in just the right amounts to make a mixture that will burn. Then the valves close, the piston moves up, compressing the mixture, and the spark plug fires. The result is not an explosion, as many people think, but a burning process. The flame moves from the plug, usually on one side of the cylinder, toward the other side quickly—but not quickly enough. Over on the far side is some of the mixture, getting hotter and hotter as the flame gets closer and the rising piston compresses it more and more. Suddenly, before the flame can get to it, that isolated mixture or "end gas" gets so hot that it ignites spontaneously before the flame front can reach it. Result: a minor explosion that detonates against the walls of its steel cell—ping. The shock of that explosion persistently banging away gradually pits and scars the walls of your cylinders. Pretty soon a carbon-valve job doesn't help anymore, and your engine sounds like a coffee grinder.

Fuel engineers in laboratories across the country have kept ahead of the ping by forever hunting up new ways to crack their crude oil. They often have to settle for less gasoline from every barrel of crude in order to produce gasoline with higher resistance to spontaneous ignition—or higher octane number. Every time they boost it another number, engine manufacturers boost compression a notch, raising the cylinder heat, and the pinging starts all over again.

That was the situation when the knock problem at Texaco landed in Ev Barber's lap. Barber, who started as a research engineer and has worked his way up to supervisor of the engineering research department, refused to be trapped in the merry octane spiral.

"I figured," he says, "that the whole thing might be solved if you could just burn up the fuel immediately as it entered the cylinder. Then there wouldn't be any 'end gas' to detonate."

That's not as easy as it sounds. Fuel needs oxygen in order to burn. The big problem was how to get the fuel to mix with the air so it would burn a split second after it entered the cylinder.

(Continued to page 266)



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for any electric drill, drill press, or flexible shaft. When ordering specify standard or Phillips head.

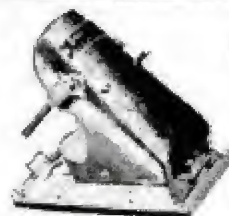
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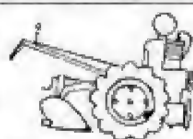
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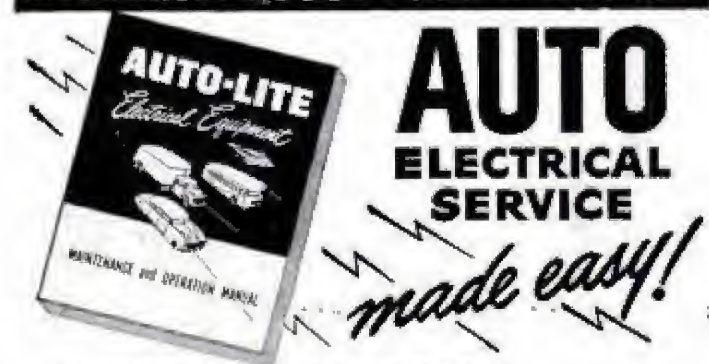


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In the machine shops of the Beacon Labs, Barber and two other young engineers, Blake Reynolds and Bill Tierney, set to work designing and grinding parts and assembling cylinders, valves and fuel jets that might do the job. Today, the results of their persistence sit on test blocks beating out a steady, knockless tattoo that is music in the ears of their bosses.

They solved the big problem of air mixture by creating a miniature tornado inside the cylinder. This whirling air whips into the entering fuel and makes it beautifully combustible almost the instant it gets inside the cylinder. To do this, the men devised a "shroud" or semicircular shield around the upper lip of the air-intake valve. So, when the valve drops open, the air rushes into the cylinder in one direction. The apron prevents it from going elsewhere. In effect, it's a jet of air, which hits the cylinder wall and follows it around, setting up a powerful swirl.

Instead of using a standard automobile fuel feed system, the engineers used a fuel jet (like the diesel system), which spurts fuel into the cylinder at an angle—downwind into the whirling air stream.

What happens, then, inside the cylinders which are pounding in the Beacon Labs today? Briefly, it is like this: as the piston moves downward on the suction stroke, the air-intake valve pops open and into the cylinder rushes a tiny typhoon. As the piston moves upward on the compression stroke, the intake valve claps shut, trapping the swirling air. Then, fuel jets downwind into the battering air stream, mixing with it. At the same time, the spark plug fires and ignites the mixture as it goes past. Firing and squirting last until the top of the piston stroke and all the fuel is burned as it goes by the spark plug. Hence, there is no "end gas" or unexploded mixture in the cylinder to ignite spontaneously as the temperature rises. And, hence, the cause of ping or knock is gone. Combustion products are ejected on a normal exhaust stroke.

"With the bugaboo banished," explains Blake Reynolds, "octane no longer matters. Low-octane fuels are as good as high, as long as they can be made to burn cleanly and efficiently—which they can. We've got ourselves an engine that will operate on practically anything but wishful thinking. And corrosive carbon deposits will be a thing of the past."

What does it all mean? With octane out of the picture, Barber and Reynolds estimate that the oil industry will be able to produce about 30 percent more automotive

(Continued to page 268)

DREMEL'S STRAIGHT-LINE ACTION GUARANTEES SCRATCH-FREE SURFACES

Here's fast cutting, finish sanding at its best. Dremel introduces a new electric sander, sturdily built to withstand hours of continuous use. It is light in weight... will not tire operator... its straight-line (non-rotary) action leaves no scratches, no rotary marks—just satin-smooth surfaces ready for any type finish. Here, for the first time, is an electric sander built for years of faithful service—all at the remarkably low price of only \$24.50.

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Craftsmen find this new Dremel model has the extra stroke and power needed for heavier woodworking projects such as cabinet-making, boat building and refinishing, garden furniture, etc. Home-owners say it's just the tool for preparing surfaces for painting and varnishing—for refinishing walls, woodwork, furniture, dry wall joints, siding and other surfaces. The Model 2000 also does a professional job of polishing waxed surfaces—eliminating all the back-breaking labor on cars, furniture, floors, stairways, etc. Industrial users likewise find this new Dremel Sander a faithful performer in furniture, cabinet, building and body shop operations.

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- *Die-cast aluminum housing with moulded Bakelite cover... Light weight, only 5 pounds... Over-all size 3 1/8" wide x 4 1/2" high x 7" long.
- *8 ft. Underwriter's Approved cord... operates on 110-120 v. A.C.

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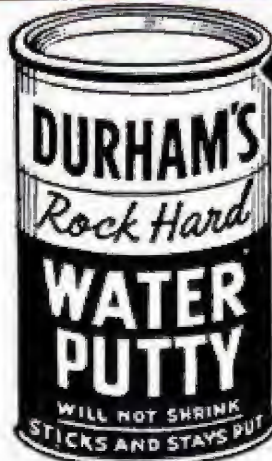


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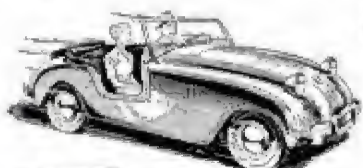


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fuel from a barrel of crude. Today your car can go 315 miles on the motor fuel from a barrel of crude—tomorrow it will go 490.

It would be a boon to the military, they point out. The Navy hates lugging hazardous high-test gas around on their warships and touchy aircraft carriers. It would give all the military services a single type of safer fuel that would work equally well in tanks, trucks, jet planes, liaison planes, Jeeps, command cars, landing craft—or practically anything else on wheels.

When will you be able to buy an automobile with this new wonder engine in it? It may be several years, though one report says that a big automobile manufacturer is considering mass production of an engine using the new combustion system.

Before it can happen, there's plenty to be done. Barber, Reynolds and Tierney still must hand-build a multicylinder unit. So far, units on the test blocks are single-cylinder affairs. Plans for the big engine are under way at Beacon now. When it's completed in 1951, the engineers will install it in a standard automobile chassis and give it a road test behind closed doors.

This is accomplished in a neat way at Beacon—on a two-story machine known as the "basement speedway." Its technical name is a chassis dynamometer. The car rolls into the second floor. Its front wheels sit in chocks, and the drive wheels rest on the top of a huge drum, suspended on a truck axle in the basement. "We've driven a million miles on it," grins Tierney, "and never left home."

A drive shaft from the drum axle goes through an electric generator, which supplies power or resistance to the drum—simulating all sorts of road conditions. The car can be tested for uphill, downhill, stop, start, fast, slow or endurance phenomena. The car engine roars; its rear wheels spin like mad, but it goes no place.

The drive shaft also drives a fan that blows air up through a tunnel and out across the front of the car, simulating highway breeze for cooling and road resistance effects. A tube, leading from the exhaust, carries fumes out of the building so they won't be trapped in the blower system and asphyxiate the car testers. Thermocouples and wires lead from the engine to the test meters on a swivel platform beside the driver's side of the car, so the "driver" can read what's happening inside his engine at all times and under all conditions.

When the new engine gets through with its multicylinder shakedown on the basement speedway next year, you should be hearing a lot more about it. But don't count on riding behind it until late in the 1950s.



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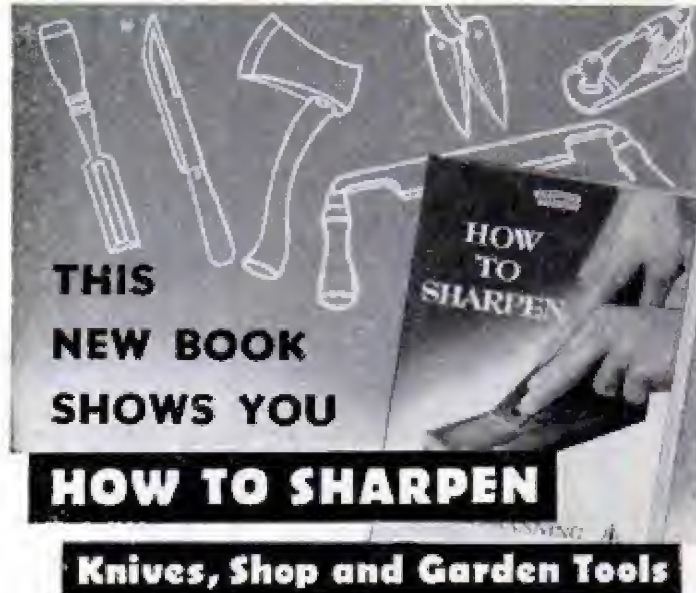
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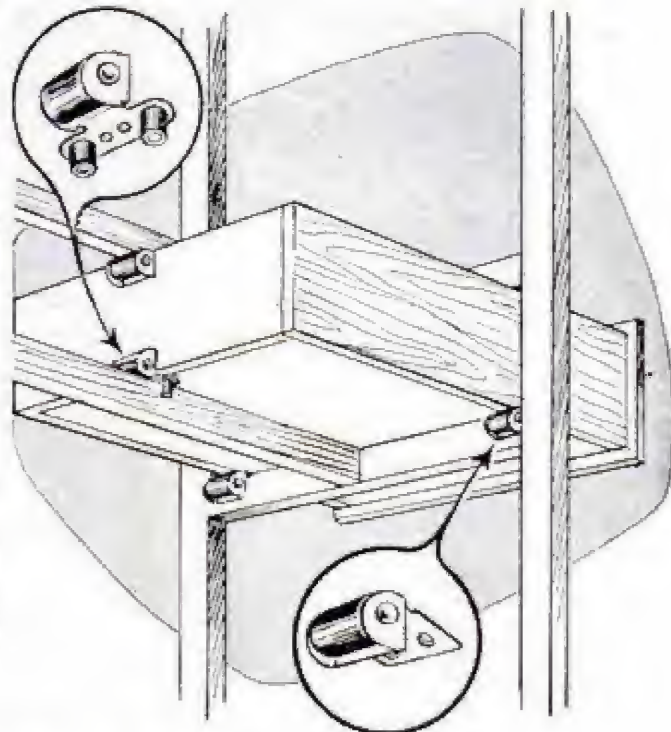
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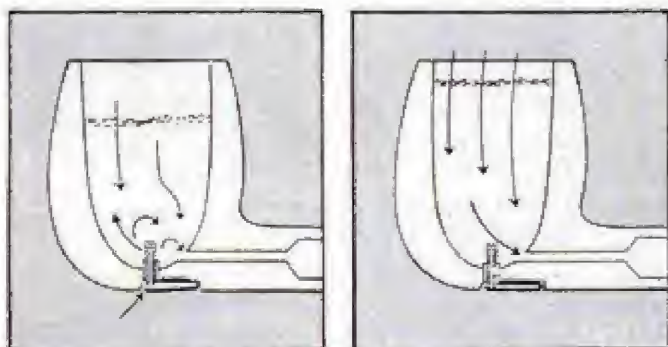
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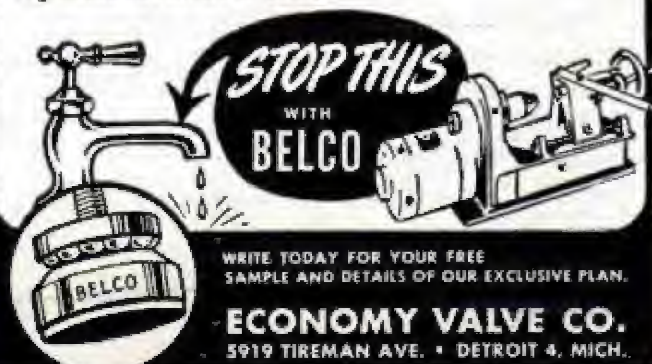
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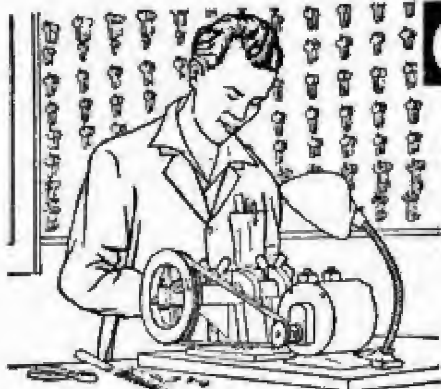
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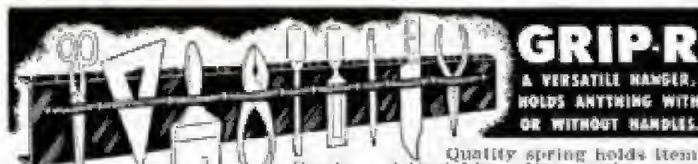
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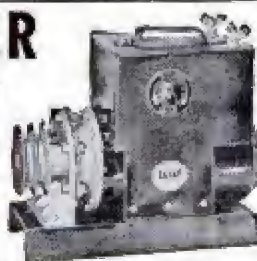
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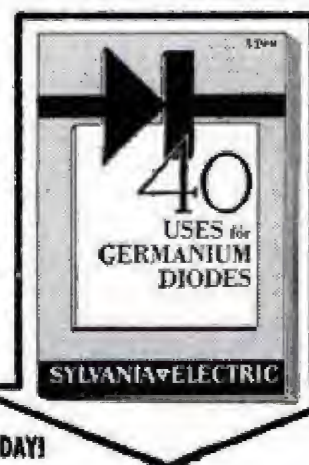
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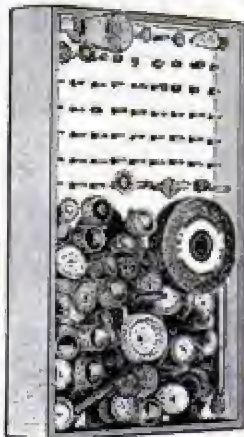
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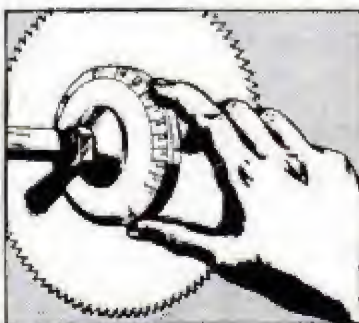
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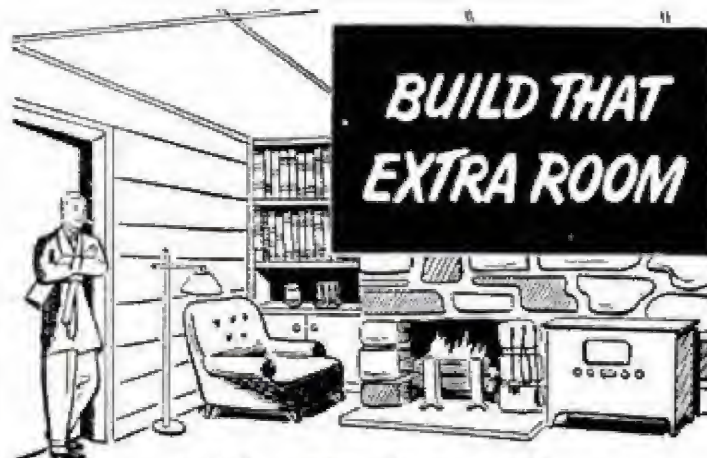


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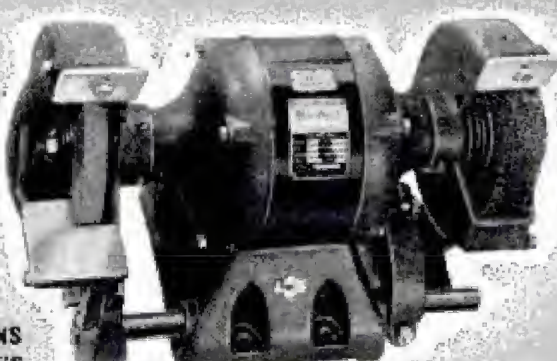
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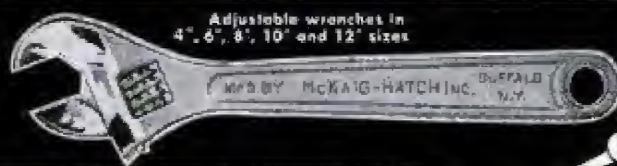
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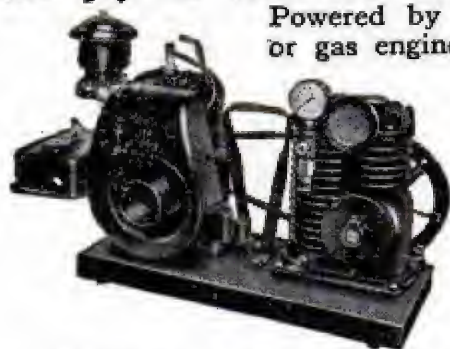
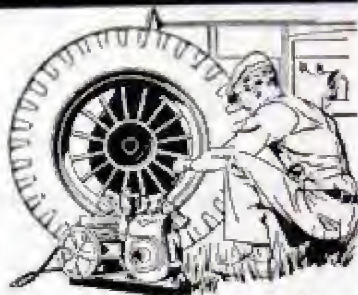
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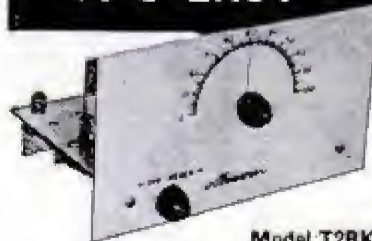
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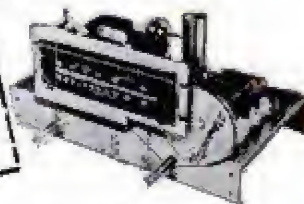
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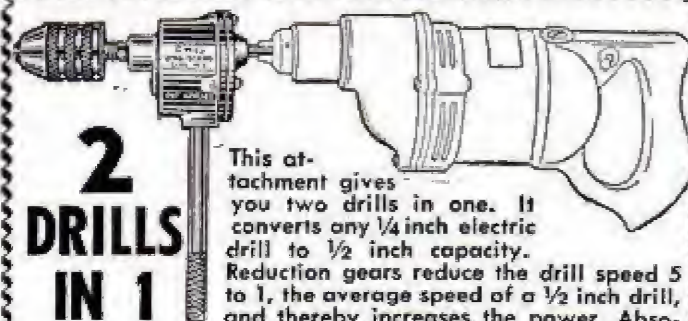
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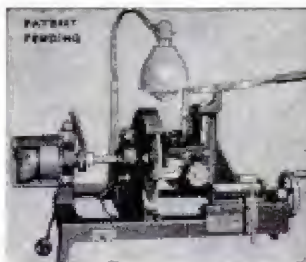


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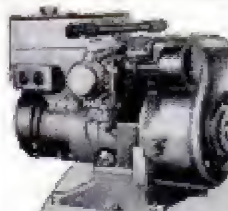
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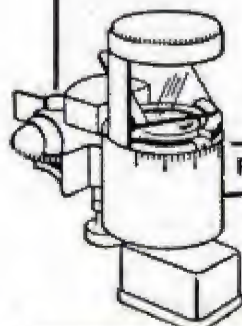
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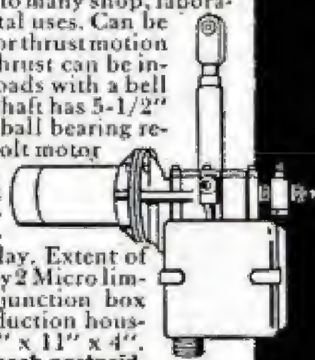


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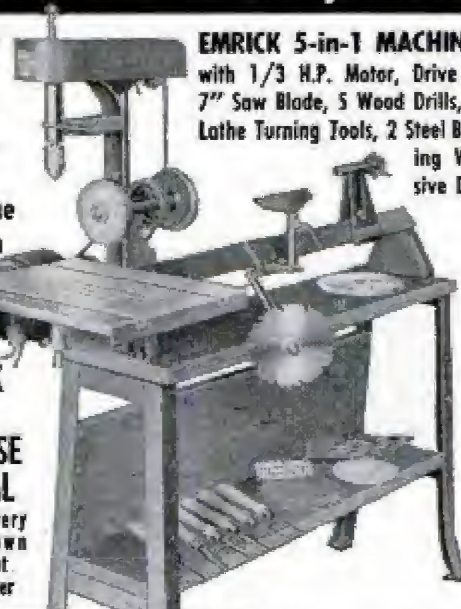
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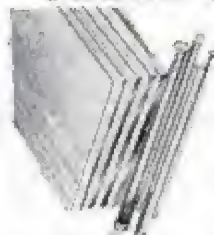
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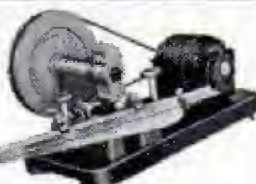
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.100"	3/32"	4.20	7.46	14.93	8.65	22.39	.62 lb.
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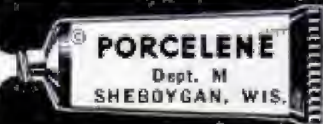
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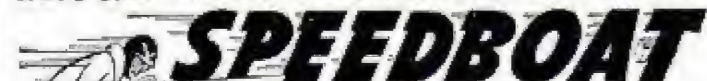
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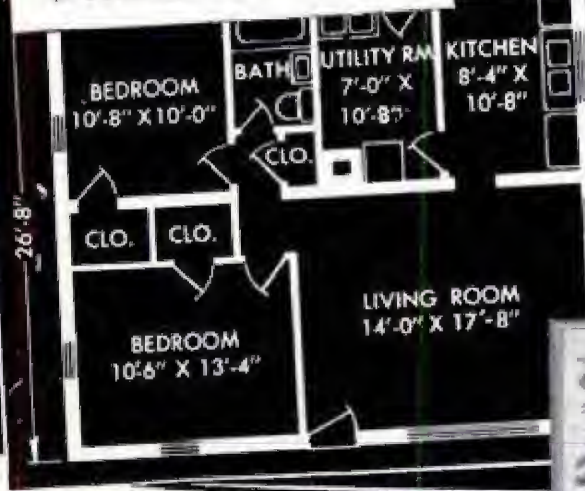
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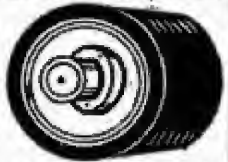
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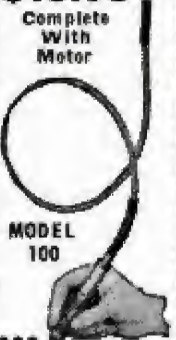
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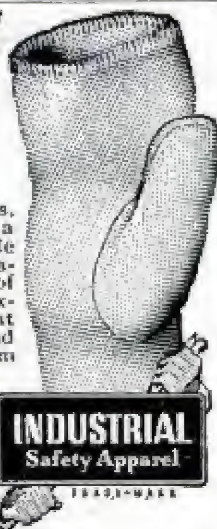
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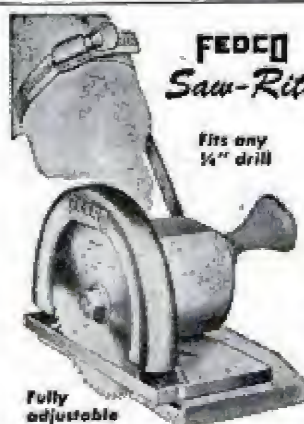
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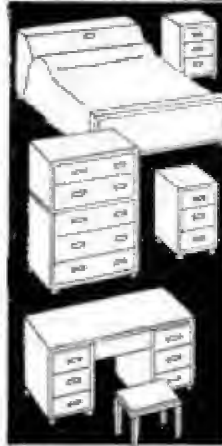
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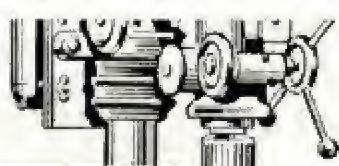
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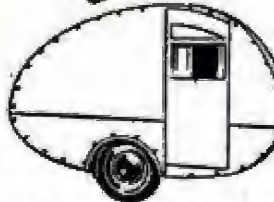
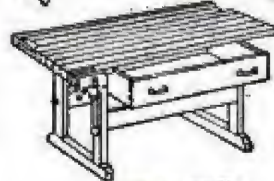
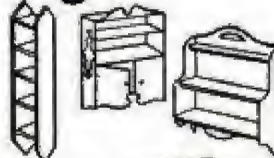
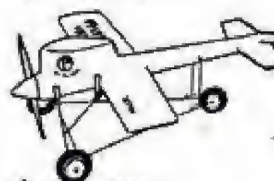
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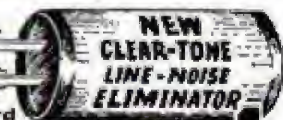
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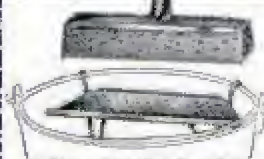
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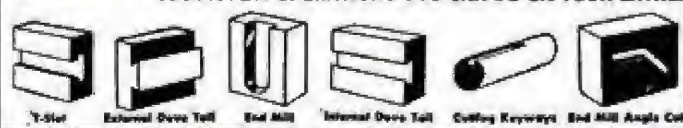
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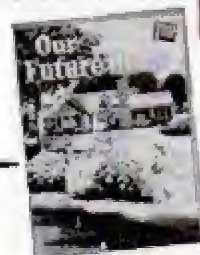
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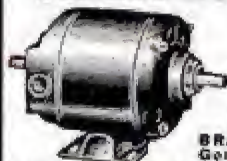
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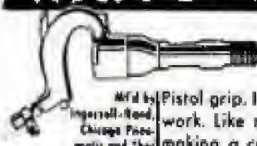
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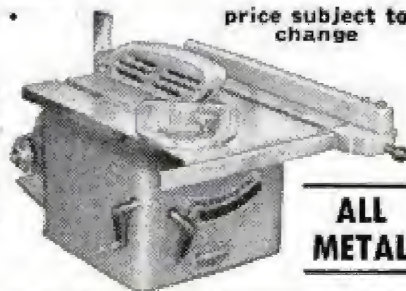
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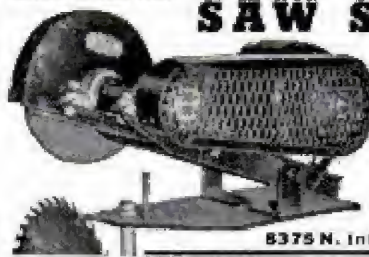


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TOM: What of it? Just feel that edge.

DAD: That's not much to go by when you're buying a chisel, son. Even a piece of cheese can have a sharp edge, you know.

TOM: You mean this chisel's no good?

DAD: I mean you can't be sure it's good. No brand name, no reputation to back it up. It's one of those bargain counter orphans—and they generally let you down.

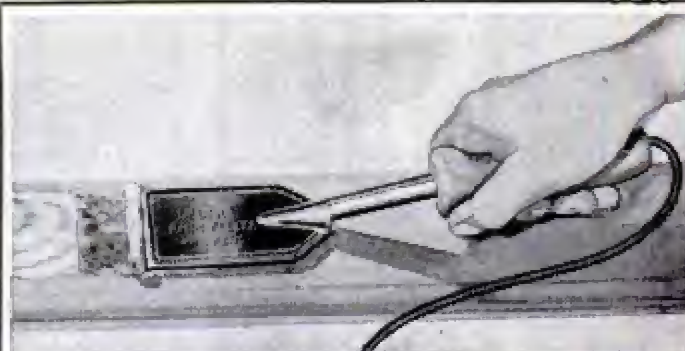
TOM: Well, it didn't cost much, anyway.

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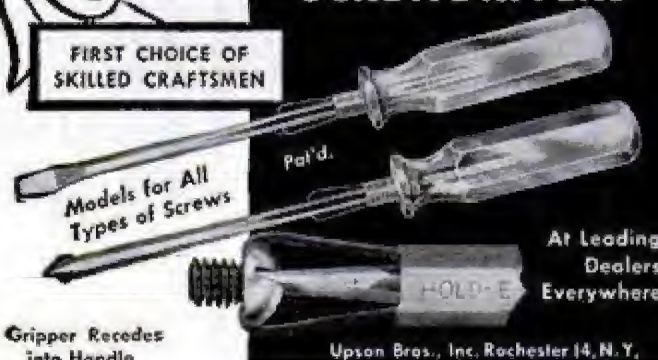
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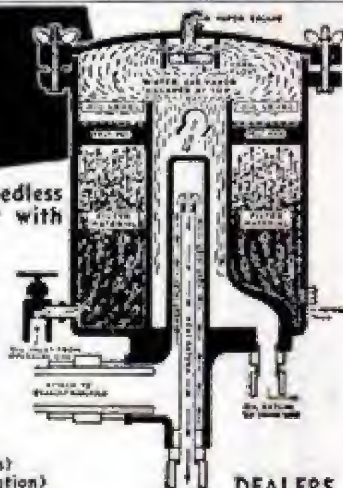
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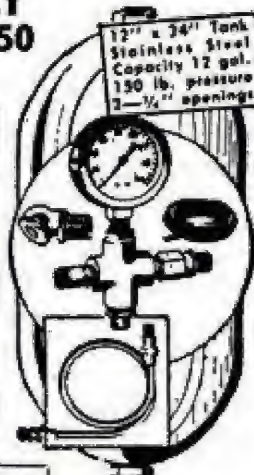
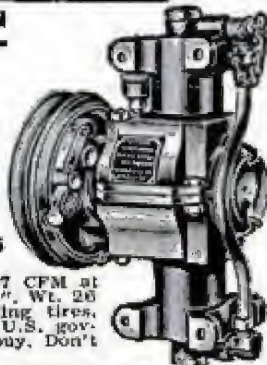
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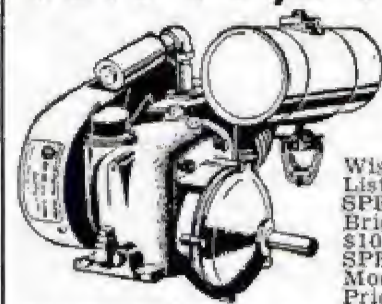
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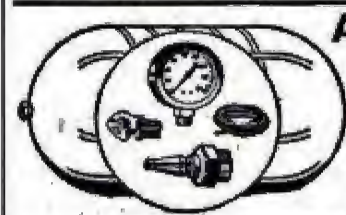
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VT-1

VICKERS HYD. TRANSMISSION

Self contained, 7 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output R.P.M. - 0 to 1/3 input R.P.M. in both directions. Input R.P.M. - 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator setup on Mills, Conveyors, Small Cars, Drives, Gear, etc. Includes two 4" Spline Shafts for input and power take-off. **2500**

Cost Government approx. \$400.00

ELECTRIC ACTUATORS

These have hundreds of uses for any mechanical device that needs a controlled two-way action, such as raising and lowering or opening and closing doors, windows, gates, shutters, valves, etc.

CTU-1 Lear No. 400A linear actuator, 24 Volt D.C. motor, 20,000 R.P.M., approximately 1/30 H.P. Drives the actuator through a high reduction gear box, resulting in 4 1/2" stroke in 14 seconds. Compression and tension loads up to 300 lbs. Has adjustable micro switch for limits of travel. Overall length retracted 10". A highly precise instrument. **ONLY 795**

CTU-2 Foote linear actuator, 24 Volt A.C. or D.C., 5500 R.P.M., 1/5 H.P. Series wound motor, 3 1/2" stroke in 13 1/4 seconds. Compression and tension loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall length retracted 11". **ONLY 695**

MOTORS

HEAVY DUTY G.E. GEAR HEAD MOTOR - 1 1/2 H.P., 24 Volt D.C., 125 Amp reversible motor drives reduction gear box unit 44.5 to 1, resulting in 168 R.P.M. at 5/8" diameter take-off shaft. Motor contains electro magnetic break.

UNIT COMPLETE **1095**
GEAR BOX ALONE **795**

MOTOR ALONE **495**

DUMORE ELECTRIC MOTOR. Adaptable to rigid or flex drive, 400 R.P.M. at power take-off. Contains 1.25 H.P., 24 Volt, 7 1/2 Amp reversible motor for indicating position. Has limit switches, magnetic brake, resistor to coordinate instrument. Overall dimensions - 6 1/2 x 4 1/2 long. **Only 750**

LEAR ELECTRIC MOTOR. 24 Volt - 6 Amps, series wound reversible motor with overload clutch. Motor turns 11,000 R.P.M. Has 11 to 1 gear reduction box turning 1500 R.P.M. or take-off. Adaptable to flex or rigid drive. **795**
Has limit switch box. Size 10" x 4".

We have available various fabricated lengths of Flex-Drive to fit Lear Gear Head motors, at \$04 base price for end fittings, plus 20¢ per ft. EXAMPLE: 48" cable total sale price \$17.20

REMOTE INDICATING SELSYN MOTOR. Will operate on 115 Volt, 60 Cycle A.C. 3/4" diameter, 2" length. Works on simple electrical connection and can be used for any distance. Turn shaft of one unit and the other will follow accurately. Can be used on TV and Ham antennas, lens focus, weather vanes, film footage and liquid levels, etc. **\$295 PAIR**

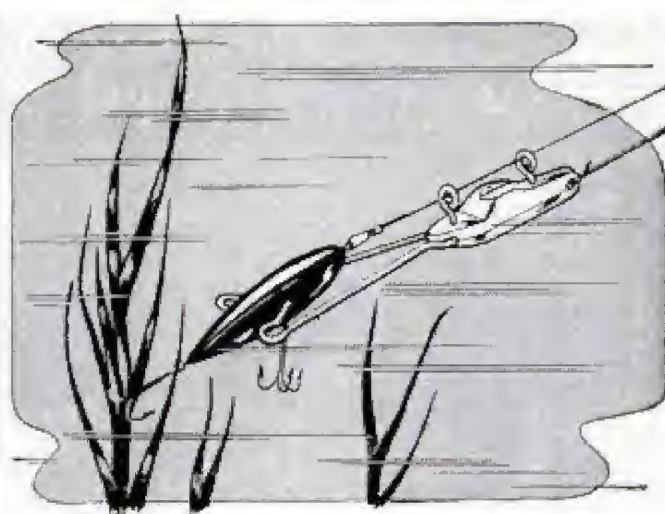
SANSELL MOTOR - 27 Volts, 16 Amps. 1/5 H.P. reversible, series wound on motor, 3600 R.P.M., shaft 9/32" diameter, 12-spline, 4-1/8" x 2-3/8", **ONLY 395**

TERMS: Order from this Ad. All sales final. All Prices F. O. B., Glendale. Pay by M. O. or Check. P. O.'s accepted from D & B. firms. 1/3 deposit with C. O. D.'s

PALLEY

SUPPLY CO

6321 SAN FERNANDO RD.
Dept. PM 9
GLENDALE 1, CALIF.



Fishing-Tackle Retriever

Fishing lures snagged on the bottom of a lake or river can be recovered with a new tackle retriever. The streamlined retriever is fastened to a long length of stout cord. The angler slips it over the fish line, which he holds taut while the retriever slides down to the snagged lure. Two wire arms form a V-shaped trap which slips over the lure and won't release. Tugging on the cord releases the tackle from the bottom.



Bottle Tilter

Small amounts of liquid can be poured easily from a big, five-gallon jug if it is installed in a new bottle tilter. Designed for laboratory and industrial use, the tilter prevents spilling and splashing dangerous liquids and facilitates measuring small amounts from the big bottle. The bottle slips into a metal framework which is pivoted to a supporting stand. A chain attached to the framework fastens around the neck of the bottle to prevent it from slipping out when it is tilted far forward.

Made directly from coal in a single stage, a new form of carbon that is hard enough to scratch glass has been developed in England.

Powell Duffryn Carbon Products, Ltd.

302 *140 Battersea Park Road* POPULAR MECHANICS

War Surplus - Tools, Machinery, Raw Materials, Clothing, etc. Illustrated with valuable info., tables, charts & data. Send 25¢ to cover handling & postage.

SAVE UP TO 85% IN WAR SURPLUS

Order from this Ad. All sales final. All Prices F.O.B. Los Angeles. Pay by M.O. or Check. P.O.'s Accepted from D & B firms. 1/2 deposit with C.O.D.'s.



PALLEY FAMOUS MIXES!! Prepared especially for the HOME CRAFTSMAN, HOBBYIST, INVENTOR, GADGETEER or SHOP MECHANIC.

GADGET MIX - Rivets, Spacers, Bolts, Screws, Gears, Wheel Bearings, Springs and Clamps. No. 106, 3 lbs. **1.19**

BEARING MIX, No. 170A. Approx. 20 needle, Ball & Roller Bearings. New & Used. Sizes: 1/2" to 4". Some of these cost Gov't \$10 a piece. Never such a value! 5 lbs. ONLY **1.59**

HINGE MIX, No. 170H. 12 pairs of Strap and butt hinges. Hinges, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. **1.09**

ABRASIVE AND GRINDING WHEEL MIX - 50 pieces including honing stone, pencil rolls, wheels, etc. A sharp value. No. 170AG **99c**

SPRING MIX, No. 206 - Torsion, Compression & Tension Springs. Ass'd. sizes. A treasure trove for emergencies. Scores of springs. 5 lbs. for ONLY **1.69**

RYLET MIX - 3 POUNDS - Consisting of sizes from 1/4" long to 3" long in many diameters & alloys. **1.19**

FILE MIX - Ten assorted Files, 4" to 12", includes 3 Vixens, half rounds, bastard, mills, etc., in seconds and used but in good condition. 1 Vixen alone worth our price for entire mix. F-1 **99c**

PULLEY MIX, No. PM-1 - You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made with 100's of uses. A WONDERFUL BUY!!! **2.95**

COUNTERSINK MIX, No. 168. Wide assortment. Excellent condition. High speed steel. Assortment of ten 100's and 110's with pilot sizes ranging from 3/32" to 3/16" No. CM-1 **2.69**

SCREW MIX - 5 lbs. incl. 2 1/2 lbs. wood screws & 2 1/2 lbs. machine screws. All sizes. Save dollars and always have plenty of screws on hand. **1.39**

NUT MIX NM-1 - 3 lbs. approx. 500 nut. Anchor, Lock, Castle, Hex, Elastic Strap Nuts, etc. You'll always have plenty of Nuts in the shop. NM-1 **1.39**

SUPER COMBO MIX - No. SC-2. Here's a real bargain. All eleven above mixes for ONLY **14.95**

REAMER MIX - No. 168. Reamer assortment. Special Taper line Finish Reamers. High Speed Steel. Slightly used but in excellent condition. Ten assorted sizes ranging from .168x.165 & .244x.215 to .425x.385 & .432x.403. One alone worth our selling price of ten. For set of ten Reamers **4.49**

METAL SHIPS - Hard steel blades. Comp'd action. Expansion spring and locking device. Right and left hand types. **NOW 2.59**

15' MONKEY WRENCH
Adjustable Jaw - Opens to 4"
Drop Forged. . . Auto Type.
Cadmium Plated **89c** Black **79c**

PIANO HINGE
Overall Width Length Price Ea.
1 1/4" (5/8" side) 72" alum. . . \$1.00
2" (1" side) 9' alum. . . \$1.75
2 1/2" (1-3/4") 34" steel . . \$1.69
BRASS HINGE - 1 1/2" (5/8" side) .040
Any length at 29¢ per ft.

PALLEY
SUPPLY CO
DEPT. PM9 GLENDALE 1, CALIF.

UTILITY BOXES FOR HOME - OFFICE, SHOP, ETC.
Transparent, with hinged lid & 25 watertight compartments. Ideal for fishing kits, small tools, cosmetics, etc. All 3 for ONLY **1.49**

TWO HEAT SOLDERING IRON
World's Hottest Iron Value!
1 to soldering iron in one with button heat control. Push the button - Select 150 or 300 Watt heat for light or heavy work. Complete with tip, bench holder, 5' asbestos cord. 110V AC. A \$15.00 Value For . . . **3.95**

INSTRUMENT MIX
6 DIFFERENT TYPES 6
Contains 1 each of the following items:
Flight Check-off • Position Indicator
Selsyn Fuel Gauge • Air Speed Indicator
Fuel/Air Ratio • Oxygen Regulator
These instruments contain sensitive meter movements, jewels, bearings, gears & valves. COST THE GOV'T MORE THAN \$500.00 SPECIAL!! ALL 6 FOR ONLY **5.95**

Speedy Aircraft Directional GYRO COMPASS
Dial is 360° swing calibrated 1/10° (6 min). Panel Mount 4 1/2" square with 3" luminous dial. Can be used in autos, planes, or boats by attaching one tube to intake manifold for required vacuum. Complete with reset caging knob. Gov't. overhauled - ONLY **\$449**

TACHOMETER - Type C-9A. Operates on direct drive with flexible shafts. Range is 0 to 4500 RPM. Ideal for use on single engine planes or boats, autos, etc. Drives direct from camshaft or at 2-1 reduction from crankshaft. **14.75**

FIRE EXTINGUISHER
Kidde Lux CO2 Type. Built to Gov't spec. Shatter-proof, heavy case. Fully recharged, with non-refillable. **19.25**
No. 602A - 7 1/2 lb. \$35 Value. **19.25**
No. 603 - 10 lb. A. \$65 Value. . . **25.75**
No. 605-A - 15 lb. New. Break disc Type. A \$75 Value . . . **29.75**
No. 605-B - 15 lb. Wheel Control Type. **32.95**
No. 605-C - 15 lb. New. Square Grip Type. \$85 Value . . **39.95**
Note: Weights listed are capacity extinguisher charge.

2 TON WINCH
Can be Hand or power operated. Has large capacity steel drum for cable. Powerful gear - reduction drive and manual brake. **36.50**

AIR COMPRESSOR
High Pressure
General Electric, 2 stage AC - DC. Rated pressure 1000 lbs. per sq. in. with 1/3 H.P. 27 volt, 7 AMP series wound motor with fan for cooling. Thousands now in use for spraying, inflating, laboratory use, etc. Can be adapted to 110 volt A.C. with transformers
A tremendous value at approx. 5% of original cost **22.50**
We also have transformers for above.

RIVET GUNS
Pistol & Gooseneck Type **\$8.95**

ALUMINUM
"Odds 'n Ends" box for sportsman, shop, or house. Decorative and sturdy. Aluminum construction. 13 1/4" x 11 1/2" x 4 **2.75**
12 1/2" x 10 1/2" x 4 **2.69**
7 1/2" x 5 x 4 **99c**

RAWHIDE Mallet
For working soft metal, or plastics, driving pins, etc. Weight 2 1/2 lbs., metal collar with rolled leather insert head. **1.09**

UTILITY HAMMER
For use as masonry chisel, stake driver, sledge, etc. Head special forged steel, sharp cutting edge. Handle is select hardwood. 1 1/2 lbs., 14" handle **79c**
2 lbs., 21" handle **99c**

AUTO PULSE PUMP - Ideal for fuel pump for auto or boat. 24 Volt D.C. Can be adapted to 6 Volt D.C. 1/8" stand. and pipe ports. **5.50**

WHEELS For Wagons, Cullies, Handtrucks, Wheelbarrows, etc. 10" dia., with 1/2" center hole. (can be drilled out to take 5/8" axle) Wheel is 1/8" steel with 10 x 1.75 heavy duty, semi-pneumatic cushioned rubber tire. **\$1.75**

1 1/2" CLARK ELECTRIC DRILL. Heavy duty. Reconditioned, made to rigid Gov't spec's. 110V A.C., 60 cycle, 1 phase, ball bearing motor, 5,000 R.P.M., 1/2" Jacobs Chuck. 8 ft. cord, slug. **15.95**

2 SPEED PORTABLE MOTOR-ENERGIZER. Used as auxiliary power source, to actuate starters or as principal power source. 1001 uses as high speed drill motor, power booster, etc. Has governor, 50 ft. electrical cable. Length 34". Power A.C., 110-115V, 60 Cycle, D.C. **NEW 27.50**
AN ELECTRIFYING BUY!

ADJUSTABLE TAP WRENCHES
Jaws are made of tool steel, hardened & tempered. Won't break or get out of line. #37 Threadwell Cap. 1/8" to 1 1/8" Length 18" **\$2.49**
#8 Vernost Cap. 3/4" to 1 5/8" Length 40" **\$3.49**
#24 Greenfield Cap. 1 3/4" to 4" Length 72" **\$6.49**

AIRCRAFT CABLE
Rust resistant alloyed steel, extra flexible, preformed - 7 x 19 strand on reels.
1/16" 34¢ 7/32" 71¢
5/64" 4¢ 1/4" 9¢
3/32" 44¢ 9/32" 18¢
1/8" 5¢ 5/16" 12¢
5/32" 54¢ 3/8" 13¢
3/16" 61¢ 1/2" 16¢
Stainless Steel Cable
1/16" 5¢ 1/8" 14¢
1/4" 24¢
Aircraft control cable 18 ft. long, 3/16" diam. with turnbuckle ends. **99c**

RUBBER
Neoprene Sheet Stock
Thickness Approx. Width Price per sq. yd.
#325 .020 1/64" 36" \$1.75
#328 .032 1/32" 22" 1.38
#330 .064 1/16" 36" 2.39
#331 .093 3/32" 36" 3.39
#329 .125 1/8" 46" 4.75
Note: No. 329 is Laminated rubber sheet with cloth center.
No. 332 - Grey Neoprene Rubber Floor Mat. Has raised non-skid Diamond pattern with durable cloth backing. Stock size: 36" x 48" x 1/16" thick **\$1.95 ea.**

NEW HYDRAULIC CYLINDER SPECIAL
Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 psi line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1 1/2" dia. piston shaft, 18" stroke, length 30 1/2". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses, etc. Cost Gov't \$398.00 **22.59**

No. 9-E HYDRAULIC CYLINDER
Double action cylinder. Has a bore of 1-3/8" and shaft of 1". Stroke is 9". Overall length 15 1/2". Built for 1500 lbs. continuous duty, 3000 lbs. intermittent duty. Will lift or push up to 2300 lbs. Can be adapted to hundreds of jobs. **NOW 8.95**

No. 3 HYDRAULIC CYLINDER
Double action. Bore is 1". Shaft 3/4". Has a stroke of 2 1/2" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8 1/2". Will take 1500 lbs. continuous duty, 3000 lbs. intermittent. Will lift or push up to 1100 lbs. **3.75**

4-WAY VALVE
Poppet Type. Valve shuts off at neutral position. Has 3/8" AC Tube Ports - 9/16 20 thread. Will stand 1,500 P.S.I. **4.75**

BENDIX HYDRAULIC HAND PUMP
Provides an instantaneous source of tremendous power for almost any heavy work. Double action stroke. Delivers .30 cu. in. per cycle at 3000 PSI. Max. press. 5000 PSI. Built-in Reservoir cap. 2 1/2 qts. 3/8" pipe outlets. Has Pressure Release Valve. 7/8" dia. by 23 3/16" overall hts. Weight 15.2 lbs. A **13.95**
\$40.00 Value for...
IN EXCELLENT CONDITION

Hydraulic PUMPS
Logan Generator type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM, or 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stand pipe ports, 1/2" spined shaft for pulley or direct attachment. 5 1/2" dia. by 7" long. Used, but condition guaranteed. **ONLY 17.50**

VALUABLE GEAR HARGAINS
6 to 1 with screw shaft #111 **\$4.98**
85 to 1 (can be used for radio, antennas, etc.) **\$3.95**

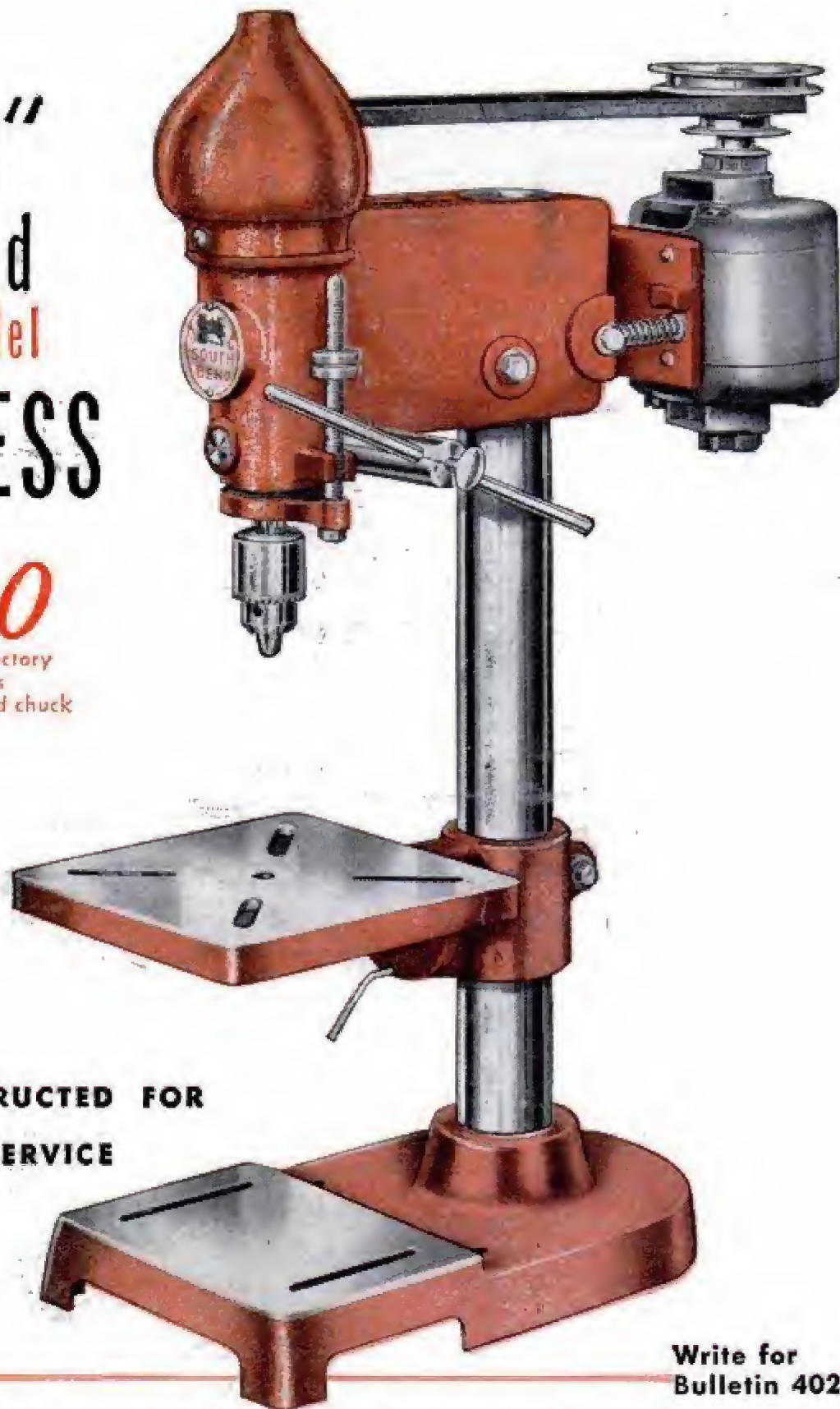
GEAR BOXES VTG-1 - 90°, 11 to 1 bevel gear 15 to 1 reduction, size 7" x 6". A Life-Time Value. **\$3.95**
VTG-2 - Inline spur gear 16 to 1 reduction, thru 4 gears. Final take-off 4 1/2" dia, 26 tooth, 1/4" Alum. spur gear. . . **\$6.49**
Just above gear boxes have lever control clutches & disengaging positive clutch. Dual proof housing. Prelubricated bearings. Both can be adapted to Vickers transmission.

ELECTRONIC TRANSMISSION GEAR TRAIN
GT-1, approx. 50 Bronze Spur & Pinion Gears - 3/8" to 4" dia, 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets, 40 N.O. ball bearings 1 1/2" to 3 1/2" dia., watch springs, bushings, posts, face plates, housings - Micro Switches, 2 miniature controlled clutches, etc. Gears in multiple size & sequence, identical teeth ratio, giving 100's of gear reduction combinations. **\$8.49**
Wt. 19 lbs.

NOTE: 72 page Hydraulic & Tool catalog. Send 25¢ to cover handling and postage.

NEW 14" South Bend Economy Model DRILL PRESS

\$69.50
f.o.b. factory
less
motor and chuck



**RUGGEDLY CONSTRUCTED FOR
MACHINE SHOP SERVICE**

Features include automatic belt tension, direct reading depth stop, full tilting table, rigid one-piece head casting, free-floating six-spline spindle, four pre-lubricated precision ball bearings, and adjustable feed tension.

Specifications: Drills to center of 14-1/4" circle, maximum drill size 1/2" in steel, spindle run out .005" or less, spindle square to table within .0075" in 5". Net weight of bench model shown, less motor and chuck is 124 lbs.

**Write for
Bulletin 402**



SOUTH BEND LATHE

SOUTH BEND 22, INDIANA
Building Better Tools Since 1906

Printed by Popular Mechanics Company, Chicago, Ill., U. S. A.

NOW AT MY RISK! I want you to read the WARNER SUCCESS PLAN



It shows you how to...
METALIZE BABY SHOES
AND OTHER KEEPSAKES

- how you can start in spare time with your home as headquarters.
- how to build—step by step—to big profits and personal independence.

This is the famous Warner Success Plan—the Plan for Personal Success in your own fascinating business that many men, married couples credit with freeing them from the limits of a pay check and from the drudgery of a time clock.

It gives the exact step by step instructions for starting a business in spare time—without risking the job or steady pay. It shows with pictures, photographs, and drawings exactly how to Metalize Baby Shoes and other keepsakes. It shows how to get the orders coming in—how to expand—how to get others working for you—how to be SURE of at least twice your present pay before you give up your job for a life of personal independence.

15 Million Prospects

There are 15 MILLION pair of Baby Shoes in the country right now ready to be Metalized. Last year alone, more than THREE MILLION more babies were born.

There's not one of these mothers who doesn't want her baby's first shoes preserved forever. The Business is tremendous... and never ending.

The Warner Success Plan shows you how to turn this exciting opportunity into cash. Shows exactly how to prepare the shoes, how to put on them a coating of genuine gold, silver, or bronze metal by simple Warner Electroplating process. Shows how to get the business coming in, how to start in spare time, how to pyramid profits. Shows you how the whole family can have fun while building for an independent future. My own Shop here in Chicago does a Big Business by the very secrets I will now unfold to you.

Read The True Facts

Don't say "Yes" now. You must have ALL THE FACTS. Then decide. First, I want you to read the entire Plan—at my risk. After investigating—after discussing it with your family—then and only then do you decide whether to use the plan and make the small investment necessary to start.



\$5.00
An Hour PROFIT

Yes, even in spare time it is possible for a man to finish enough work to pay \$5.00 an hour for his time. Think what this can pyramid into when the family helps.

3c MAY START A FORTUNE

Today I want you to do only one thing. Send the coupon. Let me give you all the facts. Remember, what I send you does not cost you a cent beyond the postage you put on your letter to me. With an opportunity like this, a man who has a serious interest in his future MUST investigate. MAIL the COUPON TODAY and see for yourself why so many families have called the WARNER SUCCESS PLAN a "godsend".

MAKE 12 TIMES YOUR MATERIAL COSTS

Remember, the Warner Process is not a cheap imitation "PAINT" process. It is the genuine METALIZING through real Electroplating. And in spite of being the best, your materials cost so little that your profits are 12 Times your material cost. Then, when mothers order the shoes mounted as book-ends, as pictures, as ash-trays or pen sets, you make the BIG EXTRA PROFITS on the beautiful mounts.

WARNER-ELECTRIC CO.
1512 Jarvis Avenue
DEPT. 3-P

Chicago 26, Illinois

DON'T SEND A PENNY
JUST MAIL THIS COUPON TODAY!

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As long as it doesn't cost me a cent, I am willing to read the facts, investigate, then give you my decision. Send the facts by next mail. Everything you send now is FREE!

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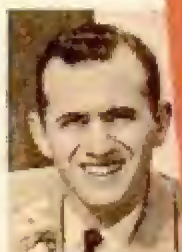
WE SUPPLY ALL MATERIALS

You don't have to go "hunting" when Warner is behind you. We supply all materials, all mounts, chemicals, and metals. And you get the low prices made possible by our big quantity purchases and our own manufacture. You send for just what you need and never have any big investment tied up in stock.



MUSICAL COMEDY
STAR — Nan
Fabray: "As
 welcome Cam
 ness and flavo

EL MILDNESS
 with my throat
 he start!", re-
 ousewife Mrs.
 e Kinney.



BOSTON RED S
 pitcher, *Mel Pa*
 "I'd walk a mil
 a Camel, any tin
 great-tasting sm



KE a pack of
 day. Every
 tastes good!
 els for me!" *R.*
ie, Personnel dir.

HOW MILD CAN A CIGARETTE BE? Smoke Camels and See!



**Millions Prove
 Camel Mildness
 in their "T-Zones"**
 (T for Throat and T for Taste)

YOU, as a smoker, know there is one sensible way to test a cigarette. The reliable test is to smoke pack after pack. That's why many smokers have made their own Camel 30-Day Mildness Tests.

And noted throat specialists confirmed Camel mildness in a coast-to-coast test of hundreds of smokers who smoked only Camels for 30 days. Their throats were examined each week—2,470 examinations. The doctors' findings: — *Not one single case of throat irritation due to smoking Camels!* But make your own 30-Day Test. You'll discover why...

**MORE PEOPLE SMOKE CAMELS
 THAN ANY OTHER CIGARETTE**

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.



RIFLE CHAMPION
Audrey Bockmann:
 "Camels certainly score
 a hit with my taste.
 And they're so mild!"



EZIO PINZA, former
 star of "So. Pacific":
 "I smoke the cigarette
 that agrees with my
 throat — Camel!"



TELEPHONE OPERA-
TOR *Ethel James:* "In
 my job, cigarette mild-
 ness is important.
 Camels are my smoke!"



DISC JOCKEY *Bob*
Maxwell: "My voice
 gets a steady workout.
 My throat welcomes
 Camel mildness."



TELEVISION STAR
Marguerite Piazza
 agrees: "As a singer, I
 enjoy Camel mildness.
 Camels taste grand!"



PETER LIND HAYES,
 comedian: "I found
 what mildness means
 when I made my
 Camel 30-Day Test!"



RADIO SONGSTRESS
Fran Warren: "Camels
 are mild! My 30-Day
 Test proved they agree
 with my throat!"



RALPH BELLAMY,
 noted actor: "Throat
 irritation doesn't go in
 show business. Camels
 agree with my throat!"



"I'VE JOINED the mil-
 lions of smokers who'd
 walk a mile for a
 mild Camel!" *Ann*
O'Rourke, secretary.



"I'VE SMOKED mild,
 cool Camels for 20
 years. Camel flavor
 suits me to a 'T'." *G.*
Campbell, sportsman.



PATRICIA MORISON,
 musical comedy star:
 "Yes, I made my own
 30-day Camel mildness
 test. It was fun."